SEVENTH ANNUAL REPORT

STATE BOARD

HEALTH, LUNACY, AND CHARITY

OF MASSACHUSETTS.

SUPPLEMENT

REPORT AND PAPERS ON PUBLIC HEALTH,

WITH A GENERAL INDEX.

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1885-1886.

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May 31, 1886.

NOTICE.

In consequence of oft-repeated requests for copies of a Public Health Supplement to the Third Annual Report of the State Board of Health, Lunacy, and Charity (1881), the announcement is hereby made, that NO SUPPLEMENT was issued for that year. Hence the following is the correct order of the series as issued: —

1. Supplement to the *First* Annual Report of the State Board of Health, Lunacy, and Charity, . . . 1879

2. Supplement to the *Second* Annual Report, . . . 1880

None issued for 1881.

4. Supplement to the *Fourth* Annual Report, . . . 1882

5. Supplement to the *Fifth* Annual Report, . . . 1883

6. Supplement to the *Sixth* Annual Report, . . . 1884

7. Supplement to the *Seventh* Annual Report (present issue), ... 1885–1886

CONTENTS.

GENERAL REPORT.

The following Supplementary Report of the Department of Health contains the results of investigations conducted by the Board, and such papers as have been presented, relative to public health for the year 1885, and also for the first five months of 1886, up to the date of the separation of the Health Department from the State Board of Health, Lunacy and Charity, and the establishment of a State Board of Health on the first of June, 1886. This report embraces the following topics: —

Malaria in Eastern Massachusetts, by Dr. Z. B. Adams, of Framingham.

Weekly Mortality Reports of Cities and Towns, for 1885.

Report upon Food and Drug Inspection.

Disposal of Sewage at Massachusetts Reformatory, by Wm. Wheeler, C. E.

Case of Lead Poisoning, by Dr. F. W. Jones.

Reports of Water Boards and Companies.

General Index of Health Supplements and Chapters on Public Health in Annual Reports.

MALARIAL FEVER.

The occurrence of this disease at intervals within the boundaries of Massachusetts, at different localities, is a matter of unusual interest. For many years previous to 1877 it had been practically unknown in the State, and save in occasional cases which had been imported from the West and South, or possibly in the cases of soldiers who suffered from intermittent fever during their sojourn in malarious regions, and were occasionally attacked after their return home, its appearance in Massachusetts was rare. At the

time of the writing of Dr. Holmes' excellent essay upon this subject (1836), and for some years after, its existence in this State was almost unknown.

In 1877 it made its appearance in the Housatonic Valley at Sheffield, and in the following years it prevailed in several towns in Berkshire, Hampden and Hampshire counties, increasing in its severity until 1882; after that year it gradually decreased, and during the past year its occurrence in the western counties has not been frequent.

Dr. J. F. A. Adams of Pittsfield contributed to the Supplement of the Second Annual Report of the Board (1880) a historical sketch of this disease, so far as it had prevailed in New England in earlier years, including also an account of the recent epidemics of 1878–1881.

In Eastern Massachusetts malarial fevers were almost unknown until July of last year, when a sudden outbreak occurred at Framingham, confined to a comparatively limited area, in the course of which epidemic nearly two hundred people were attacked by the disease. An account of this outbreak may be found in the present report, as detailed by Dr. Z. B. Adams of Framingham.

Weekly Mortality Reports of Massachusetts Cities and Towns.

These reports have been continued throughout the year, and furnish a continuous index of the health of the population of the cities and towns contributing to the report. The returns which are received at the office of the Board each week are there compiled, published and distributed to the local boards of the cities and towns. Nearly all the cities, a majority of the larger towns, and also many of the smaller towns representing the urban population, as well as a considerable portion of that of the country districts, return weekly reports of mortality to the Health Department. The mortality of the cities is also reported to the daily papers for publication.

The summary of these reports for the year 1885 shows a slight improvement over the general mortality-rate of the previous year. No serious epidemics prevailed during the year, and the reports show a slight diminution in fatality

from all the reported infectious diseases except measles, acute lung diseases and small-pox. The reported deaths from measles increased from 46 in 1884, with a ratio per 1,000 deaths of 1.89, to 139 in 1885, with a ratio of 5.63 per 1,000 deaths. The reported deaths from acute lung diseases had increased from 2,563 in 1884, with a ratio of 105.7 per 1,000 deaths, to 3,063 in 1885, with a ratio of 124.9 per 1,000 deaths. The greatest mortality from this class of diseases was in the spring months, the two seasons of 1884 and 1885 showing the following reported mortality for the months of February, March, April, May and June:—

MONTHS.	1884.	1885.
February, ...	69	92
March, ...	73	114
April, ...	66	118
May, ...	42	89
June, ...	35	36

The reported deaths from small-pox were eleven; this increase over the small number of 1884 (two) being clearly traceable to the influence of the serious epidemic at Montreal. The majority of the cases occurred during the prevalence of that outbreak, and were mainly among the unvaccinated French Canadian population who were in more or less direct communication with the British provinces.

Great pains are taken not only to ascertain all the facts relative to the origin of each individual case, but also to urge upon local authorities the necessity of the most careful sanitary precautions for the prevention of the disease. There can be no doubt that, by the careful and thorough execution of such measures as are provided by the statutes, small-pox may be entirely excluded from any community, or at least confined to the first cases which may occur.

No attempt has been made in the past year to tabulate

the returns of reported cases of cerebro-spinal meningitis, in consequence of the apparent want of accuracy in the reporting of cases.

Several cases of this disease were reported to the Board as having occurred in the town of Billerica, and were believed by some to have spread through the medium of the public schools; in consequence of which report Dr. D. F. Lincoln made a careful inquiry, and reported as follows: —

BOSTON, Jan. 11, 1886.

I have the honor to report as follows concerning a visit made by me on the 8th inst. to a locality in Billerica, reported as being affected by an epidemic: —

Seven cases have occurred, all among children from three to ten years of age. One case proved fatal in a week; the others have either recovered or seem in a fair way to recovery.

The symptoms were mostly referable to the cerebro-spinal centres. The disease commenced rather suddenly, with full development of symptoms within twenty-four hours, or even within twelve, in most cases.

Retraction of the head, with pain and tenderness of the cervical vertebral region, in all the cases; tenderness in one case extending down to lower angle of scapula.

Delirium and coma in most; three cases delirious when first seen.

Headache prominent in all but one case; in most, severe.

Pupils irregular, with squinting (convergent) in most.

Fever quite high on the first day; in three cases the temperature on that day stood at $104\frac{4}{5}°$, 105°, $105\frac{3}{5}°$.

Pain in stomach and vomiting, early symptoms. Dysenteric symptoms, rather severe (pain, bloody flux) in the two cases first attacked.

Pain in regoin of liver, also pain in right or left side of bowels, with tympanites, in two or three cases.

Marked constipation (lasting two and one-half days) in one; somewhat in other cases.

Sore throat at the outset in one. Another attack was ascribed by parent to catching cold. The child that died had been weakened by a previous attack of tonsillitis.

In order to form some idea of the causation (if possible), I visited the houses of the patients, in company with Dr. Lane and Mr. Baker, to both of whom I am much indebted. The cases all occurred within the practice of Dr. Lane.

1. *Communication of the Disease.* — The seven cases occurred in six families, embracing twenty-six children. The two cases occurring together were those of twin boys, who were attacked on the same day. There has been, therefore, no spreading of disease within families.

The family in which the first cases occurred live at East Billerica, two and one-half miles from the central part of the town where all the others occurred; the two districts are on different lines of railroad, and there is not very much travel between them. The children had never been at the house where the second attack occurred. None of the children that have had the disease since, have visited these two during the past six months; in fact, it is said that no child from the Centre had been there.

At house No. 2 (Centre), none of the children that have had the disease have visited the patient. One little girl was with her all the first night, while the patient was very sick, but has not been attacked.

The communication between any two of the children attacked was denied by all the families seen. Visits between the families were not interdicted, however, and the physician did not give them to understand that the disease was contagious.

2. *School Influences and Surroundings.* — In East Billerica, the children attacked had not been to school that season.

In the Centre, the school-house is of two stories, with one room in each; there were less than twenty pupils in the lower room, and about twenty-three in the upper. Size of upper room, 28½ by 31½ and 12 feet high, giving an allowance of 450 cubic feet per scholar; the room seemed wholesome and suitable. The cellar was not accessible from the inside of the building; had no floor, and had standing water in one part, and damp soft earth over the rest; it is not used, and has no windows or ventilation. The privy was some six feet in the rear, and its vault was about on a level with the lower part of the cellar of the school-house; not specially offensive.

Four of the five patients at the Centre attended the school, *all* being attendants upon the *upper-room class.* One patient, aged three, had never been to school.

The teacher stated that two of these four patients had had severe colds previous to the illness, while the others had not; and one was as well as ever on the day she was taken ill.

3. *Water.* — The scholars drink water from a town pump in the street, distant 120 feet from nearest water-closet or privy, which is said to be a well-kept tight vault, in a large boarding-school for boys. The water-pail was neat.

The families use water from wells situated respectively at distances of 40, 40, 30, 20, — and 12 feet from the privies. There is nothing peculiar to these families in this proximity.

The Centre is located on a high hill of contorted mica-schist; water found in abundance near the surface.

In consequence of the continued occurrence of occasional cases of typhoid fever, especially among the smaller towns, and the need of more widely diffused information relative to the causes and prevention of this disease, the following circular was prepared for general distribution: —

SUGGESTIONS FOR THE PREVENTION OF TYPHOID FEVER.

A Circular from the State Board of Health, Lunacy, and Charity, May, 1886.

Typhoid or enteric fever is a continued fever, "associated with an eruption of rose-colored spots, chiefly upon the abdomen, appearing generally from the eighth to the twelfth day of the disease, occurring in crops, each spot remaining visible about three days. Languor and feebleness are prominent symptoms from the first, attended with headache and abdominal pain, and early by diarrhœa. This symptom usually ceases in the latter stages of the disease. Other special symptoms are fullness, resonance and tenderness of the abdomen. The fever may terminate favorably by gradual convalescence in the fourth week, the average duration being about twenty-three days. In most fatal cases death occurs during the fourth week." [Aitken.]

Typhoid fever prevails throughout the year in New England, and is usually more prevalent in the autumn months than at other seasons of the year. Of 22,445 deaths from this disease, occurring in Massachusetts during the twenty years ending with 1881, 11,810 or more than half occurred in the months of August, September, October and November.

It is common to all ages, cases occurring in infancy and in old age. It is most frequent between the ages of fifteen and forty years; about one-half of the deaths reported above having occurred in that period and about two-thirds between the ages of ten and fifty years.

Mode of Propagation.

Typhoid fever is an infectious disease. It is undoubtedly communicable, though not positively contagious, in the restricted sense of personal contact. It is more than probable that the poison of

typhoid fever is conveyed from the sick to the well through the medium of the fecal discharges, and that such is the most common method of its transmission. The media of communication may be the air or the drinking-water, more commonly the latter. Its introduction by food has also been demonstrated, especially by milk. The difficulty of discriminating between these media, water and milk, in certain cases, is recognized, especially in large cities.

Prevention.

The *purification and protection of public and private water supplies from pollution* is one of the best measures for the prevention of this disease. The Caterham epidemic, which occurred in England in 1878, in which 352 cases and 21 deaths followed the pollution of a public water supply by the typhoid excrement of a single person, and more recently the epidemic at Plymouth, Pa., which was still more destructive, and where a similar origin was distinctly traced, were noted examples of the pollution of public water supplies.

Single cases and detached groups of cases are much more commonly traced to private wells as their source, in consequence of their proximity to cesspools, vaults, barn-yards, pig-styes and other contaminating sources. Hence, isolated farm houses, thinly settled districts, as well as small but compact villages, without a public water supply, are more liable to the occurrence of the disease than cities having a public supply. The enormous dilution of the latter, as well as its location, often in an elevated place, apart from neighboring villages and sources of infection, give to it the requisite immunity from danger. In Massachusetts, for the ten years, 1871–1880, the number of deaths per thousand of the population from typhoid fever was 6.37. In nearly all of the twenty cities the rate was less than that of the State, while in all of the forty-seven towns, except three, in which the rate exceeded 10 per thousand for the same period, there was no public water supply, and in two of these three which had public supplies, the water supply had been introduced since the beginning of the period named.

The great value of pure water supplies, and efficient drainage systems of municipalities, in the reduction of this disease is shown by the experience of English cities and towns, in nearly all of which a very decided reduction in mortality from typhoid fever followed the introduction of such works.*

* Ninth report of the Privy Council. England, 1866. Sixth annual report of the State Board of Health of Massachusetts, 1875.

Duties of Local Authorities with Reference to Typhoid Fever.

1. To investigate the source or origin of the disease, and to take measures to prevent the further use of well-waters, if such be shown to be its mode or medium of communication, until the source of infection is remedied.

2. Isolation of the sick. While the separation of the sick from the well is desirable, it is not essential that the same restriction as to intercourse should be required, as is necessary in the case of small-pox or scarlet fever, since there is no evidence that this disease is conveyed from the sick to the well through the medium of a third person.

3. Disinfection of the discharges of persons sick with the disease should be required, as well as of vaults and other appliances used by them, and also of bedding, clothing and apartments used by the sick, especially when soiled.

4. Notices of all cases should be required from attending physicians in compliance with the provisions of the Public Statutes. Such notice should contain the name, age and residence of the patient, the name of the disease, the date of the first visit and the name of the reporting physician. Postal cards or blank forms may conveniently be used for this purpose.

The amendment to the Public Statutes, enacted by the Legislature of 1884, relative to diseases dangerous to public health, is as follows: —

Chapter 98. Acts of 1884.

Section 1. When a householder knows that a person within his family is sick of small-pox, diphtheria, scarlet fever or *any other disease dangerous to the public health*, he shall immediately give notice thereof to the selectmen or board of health of the town in which he dwells, and upon the death, recovery or removal of such person, the rooms occupied and the articles used by him shall be disinfected by such householder in a manner approved by the board of health. Any person neglecting or refusing to comply with either of the above provisions shall forfeit a sum not exceeding one hundred dollars.

Sect. 2. When a physician knows that a person whom he is called to visit is infected with small-pox, diphtheria, scarlet fever or *any other disease dangerous to the public health*, he shall immediately give notice thereof to the selectmen or board of health of the town; and if he refuses or neglects to give such notice, he shall forfeit for each offence not less than fifty nor more than two hundred dollars.

Sect. 3. The boards of health in the several cities and towns shall cause a record to be kept of all reports received in pursuance of the preceding sections, and such record shall contain the names of all persons who are sick, the localities in which they live, the diseases with

which they are affected, together with the date and the names of the persons reporting any such cases. The boards of health shall give the school committee immediate information of all cases of contagious diseases reported to them according to the provisions of this act.

SECT. 4. The Secretary of the Commonwealth shall furnish the boards of health with blank books for the record of cases of contagious diseases as above provided.

SECT. 5. Sections seventy-eight and seventy-nine of chapter eighty of the Public Statutes are hereby repealed. [*March 17, 1884.*

It is desirable to include the following particulars in such a notice as is required in the act quoted above.

NOTICE OF INFECTIOUS DISEASE.

Name of patient, ——— ; age of patient, ——— ; disease, ——— ; residence, ——— M. D.

Date.

DISINFECTION.

The following are recommended as the most efficient disinfectants for use in connection with this disease: —*

For the disinfection of excreta. — 1. A solution of chloride of lime in the proportion of 4 parts of the chloride to 100 of water; 2. A solution of bichloride of mercury, 1 part to 500 of water.

For the disinfection and deodorisation of the surfaces of masses of organic material in privy-vaults, etc. — Chloride of lime in powder.†

For clothing, bedding, linen, etc. — 1. Burning, if the articles are of little value; 2. Boiling, for at least half an hour; 3. Immersion in a solution of bichloride of mercury, of a strength of at least 1 part to 2,000 of water for at least four hours; 4. Immersion in a two per cent. solution of carbolic acid for four hours.

For outer woollen garments which might be injured by the foregoing methods. — 1. Exposure to dry heat at a temperature of 230 F. (110 C.) for two hours; 2. Fumigation with sulphurous acid gas in a closed apartment, where the sulphur employed is in the proportion of three pounds to each thousand cubic feet of air.

For the person. Hands, or other portion of the body liable to be soiled. — 1. Solution of chlorinated soda, 1 part to 10 of water; 2. Solution of carbolic acid, 2 parts to 100 of water.

For the bodies of the dead. — Wrap in a sheet saturated with a solution of chloride of lime, 4 parts to 100 of water, or of bichloride

* As advised by the committee on Disinfectants of the American Public Health Association.

† The chloride of lime for this purpose may be diluted with nine parts of plaster of paris, or the same proportion of clean, dry sand.

of mercury, 1 part to 500 of water, or of carbolic acid, 5 parts to 100 of water.

For the sick-room, after the death or recovery of the patient. — Fumigation with sulphur for twelve hours, at least three pounds being used for each 1,000 cubic feet of air space, to be followed by the washing of surfaces with a solution of bichloride of mercury, 1 part to 1,000, or of carbolic acid, 2 parts to 100 of water. For the fumigation the sulphur may be broken in pieces, and put into an iron dish or other vessel, and set in a basin of sand, or floated in a tin pail partially filled with water. It may be set on fire by sprinkling it with some alcohol and applying a lighted match. The apartment cannot be occupied during such fumigation, but should be tightly closed for at least twelve hours, and should be well aired after the disinfection is accomplished. As it has been conclusively demonstrated that the fecal discharges of the sick are the chief vehicle of communication in this disease, their disinfection should be carefully and thoroughly performed, and especially should care be taken as to their disposal, so that no portion of them can gain access, either directly or indirectly, by surface drainage, percolation, filtration, or otherwise, to any water supply.

The supply of circulars relative to scarlet fever and diphtheria having become exhausted, a new edition of each was prepared, with such changes as more recent information relative to these diseases suggested.

Inspection of Food and Drugs.

The reports of the analysts, detailed in this supplementary report, embrace their work for the year 1885, and the first five months of the present year, under an appropriation of $10,000 (Act of 1884).

The inspection of food and drugs has been systematically conducted under the supervision of the Health Department, and the provisions of the statutes have been uniformly complied with, relative to the expenditure of a definite portion of the appropriation (at least three-fifths) for the execution of the laws relative to milk and milk-products.

The experience of the past year fully confirms the statement made in a previous report * relative to the amount of actual saving to the people of Massachusetts effected by the execution of the food and drug acts. The annual gain to

* Supplement to Sixth Annual Report, page xii.

the consumers amounts to many times the cost of the enforcement of the statutes in this direction.

By this central supervision, which has been extended to all portions of the State, and is now systematically conducted as a distinct department of the work of the Board, efficient protection is afforded which could not be accomplished by local inspection alone. Especially is this true with reference to the inspection of milk. The knowledge that the Health Department exercises a constant watchfulness over the milk supply has had the effect of a marked improvement upon the quality of this most important article of food in the cities and large towns of the State.

The Disposal of Sewage at the Reformatory at Concord.

By the provisions of chapter 167 of the Acts of 1883, the Commissioners of Prisons were authorized to provide for the disposal of the sewage of the Reformatory at Concord, which had hitherto been conducted in an unsatisfactory manner. The plans of such method of disposal were to be submitted to the State Board for its approval.

William Wheeler, C. E., was selected to make the necessary plans and to supervise the work of construction, which was carried out under his direction; the sewage being mainly disposed of by the process of irrigation on land adjoining the prison, which is of a suitable character for such disposal.

Case of Lead Poisoning.

Since the publication of the results of an inquiry relative to lead-pipe poisoning (Second Annual Report of the State Board of Health, 1871), the occurrence of such cases appears to have been less frequent. Dr. Jones reports a case illustrating the common use of lead-pipe for the conveyance of water. Many more such cases would doubtless occur, were it not for the fact that the action of different well-waters upon lead is quite variable.

Triennial Reports of Water Boards and Water Companies.

In compliance with the provisions of chapter 80, sections 103, 104 and 105, of the Public Statutes, requiring all

Water Boards, Commissioners and Companies in Massachusetts to make returns to the State Board, and also requiring the Board to publish such returns in its report to the Legislature, such a report was made in the supplement to the Fourth Annual Report of this Board, and at the expiration of three years a second report is now presented.

Much of the material in the present report must necessarily be identical with that which was presented in the report of 1882–83. It may, therefore, reasonably be asked whether the republication of this material may not be wisely omitted in future, or at least limited to the data obtained from companies which have begun operations since the publication of such returns.

Arsenic in Wall-Papers.

In a recent article by Prof. E. S. Wood, entitled "Arsenic as a Domestic Poison" (published in the Supplement to the Fifth Annual Report of the Board), the following points were clearly set forth: —

1. The extensive employment of arsenic in the coloring of articles for domestic use.
2. The form in which it is used.
3. The danger of poisoning, which occasionally results from such use.
4. Legislation, and measures adopted in other countries for the prevention of harm.

The report of the State Board of Health for 1872 also contains a valuable paper by Dr. F. W. Draper, entitled "The Evil Effects of the Use of Arsenic in certain Green Colors," in which are detailed such facts as were known at that time relative to the poisonous effects of arsenic in wall-papers and other papers. At that time the arsenical pigments used in coloring papers were chiefly of some shade of green. This inquiry, as well as similar investigations in other States, resulted in a considerable diminution in the evil. Later inquiries, however, have shown that poisonous colors are not limited to the shades of green, and that, of a considerable number of papers examined, the green colors were as free from poison as any.

The papers, of which specimens were shown in Dr. Wood's article, presented considerable variations in the quantity of poison contained in them, the limits being 46 milligrams per square meter (.59 grains per square yard) up to 523 milligrams per square meter (6.7 grains per yard) for the wall-papers, and a maximum of 4,341 milligrams per square meter (55.9 grains per square yard) for the box, or glazed and plated papers.

This question was the subject of a careful inquiry by the Health Committee of the Legislature of 1886, but notwithstanding the considerable amount of evidence offered by experts, as well as by actual sufferers, in support of the bill which was presented, it failed to become a law.

Since that inquiry several new cases, alleged to have been produced by poisonous papers, have been brought to the notice of the Health Department, and the papers to which the illness was attributed have been submitted to analysis. Other papers, also, mostly of recent manufacture, have been examined with the following results: —

Whole number of samples examined, . .	88
Number containing arsenic, ...	60
Number containing none, ...	28

Of the number containing arsenic there were reported as having *much arsenic*, 34; number having *considerable arsenic*, 9; number having a *trace of arsenic*, 17.

A Brief Summary of the Work of the Board with Reference to Public Health.

During the period of nearly seven years since the organization of the Health Department of the State Board of Health, Lunacy and Charity, the following subjects have received the attention of the department, and the results of inquiries have been published in the Annual Supplements of the Board as follows: —

WATER SUPPLIES, WATER POLLUTION, ETC.

First Supplement. — The Pollution of Streams, by Dr. C. F. Folsom; The Westfield and Merrimac Basins; Pollution of a Brook by Sulphuric Acid, by Prof. W. R. Nichols; The Water Supply of Cambridge, by Prof. E. S. Wood, M. D.; Observations on Fresh Pond, by Prof. W. R.

Nichols; Examination of Mystic Water, by Prof. W. R. Nichols; Algæ in a Storage Basin, by A. Fteley, C. E.; Vegetable Impurities of Drinking Water, by Prof. W. G. Farlow, M. D.; Medical Correspondence on the Mystic Water Supply.

Second Supplement. — The Deerfield and Miller's River Basins, by W. E. Hoyt, C. E.

Fourth Supplement. — Reports of the Water Boards, Commissioners and Companies of Massachusetts.

Fifth Supplement. — Tubular Wells for Domestic Water Supply, by J. C. Hoadley, C. E.

Seventh Supplement. — Reports of the Water Boards, Commissioners and Companies of Massachusetts.

SEWERAGE, DRAINAGE AND SEWAGE DISPOSAL.

First Supplement. — Suggestions on Sewerage, by E. C. Clarke, C E.; The Drainage of Summer Hotels and Country Boarding-houses, by E. W. Bowditch, C. E.

Second Supplement. — The Separate System of Sewerage, by E. C. Clarke, C. E.

Fourth Supplement. — The Sewerage of Nahant, by E. W. Bowditch, C. E.

Fifth Supplement. — The Sewerage of Nantucket.

Seventh Supplement. — Sewage Disposal at the Massachusetts Reformatory, by Wm. Wheeler, C. E.

FOOD AND DRUGS.

Inspection, Adulteration, Etc.

First Supplement — Trichinæ in relation to Public Health, by F. S. Billings, V. S.; The Adulteration of Staple Groceries, by Ellen H. Richards.

Fourth Supplement. — Adulteration of Food, by S. P. Sharples, S. B.

Fifth Supplement. — First Report relative to Food and Drug Inspection under Statutes relative to such Work, with Reports of Analysts; Trichinosis, by Dr. S. W. Abbott, Health Officer.

Sixth Supplement. — Second Report relative to Food and Drug Inspection.

Seventh Supplement. — Third Report relative to Food and Drug Inspection.

CONTAGIOUS AND INFECTIOUS DISEASES, ETC.

First Supplement. — Typhoid Fever in Middlesex County, by Dr. S. W. Abbott; Typhoid Fever in Brookline, by Drs. R. Amory and G. K. Sabine; Typhoid Fever in Other Towns.

Second Supplement. — Intermittent Fever in Massachusetts, by Dr. J. F. A. Adams; Epidemic at Adams, by Dr. J. F. A. Adams; Neglect of Vaccination, by Dr. Z. B. Adams.

Fourth Supplement. — Leprosy in its Relations to Public Health, by Dr. S. W. Abbott.

Sixth Supplement. — Epidemic Cholera, by Dr. S. W. Abbott; Disinfection..

Seventh Supplement — Malaria in Eastern Massachusetts, by Dr. Z. B. Adams.

SCHOOL AND INDUSTRIAL HYGIENE.

Second Supplement. — Schoolhouse Sanitation, by E. W. Bowditch, C. E.

Fourth Supplement. — Our Eyes and our Industries, by Dr. B. J. Jeffries.

Sixth Supplement. — The Sanitary Condition of School Buildings in Massachusetts, by Dr. D. F. Lincoln.

HEALTH OF CITIES AND TOWNS.

Second Supplement. — The Sanitary Condition of Holyoke, by E. W. Bowditch, C. E.

Fifth Supplement. — The Sanitary Condition of Somerville, by Dr. J. F. Couch; The Sanitary Condition of Nantucket; The Weekly Mortality Reports of Cities and Towns.

Sixth Supplement. — The Sanitary Relations of Taunton, by Dr. E. U. Jones; The Health of Towns; The Weekly Mortality Reports of Cities and Towns.

Seventh Supplement. — The Weekly Mortality Reports of Cities and Towns.

POISONS.

Fifth Supplement — Arsenic as a Domestic Poison, by Dr. E. S. Wood.

Sixth Supplement. — A Study of the relative Poisonous Effects of Coal and Water Gas, by Profs. W. T. Sedgwick and W. R. Nichols; The relation of Illuminating Gas to Public Health, by Dr. S. W. Abbott.

Seventh Supplement. — Case of Lead-pipe Poisoning, by Dr. F. W. Jones.

Other Sanitary Matters.

In addition to the work represented by the papers and reports included in the Supplementary Reports of the Health Department, the Board has also discharged such administrative duties as are defined by the statutes in the regulation and suppression of noxious and offensive trades in localities where such trades have become injurious to the health and comfort of the neighboring population. The health officers of the Board have made frequent visits to such localities, and rendered such assistance and advice as each case required. The operations of the Board in this direction are

detailed in the annual reports of the Board in the sections relative to Public Health.

The subject of contagious diseases has been under constant and careful investigation by the Board, which has frequently, through its health officers, conferred with the local authorities of cities and towns, in some cases assuming such control as is authorized by the statutes, especially where small localities appeared to be powerless to act; especially has this been the case with small-pox, which fortunately, with the exception of the years 1881 and 1882, has not prevailed to any considerable extent in the State. The principal direction from which small-pox invaded Massachusetts, both in the epidemic of 1881 and 1882 and also in 1885, was from the British provinces; unvaccinated French Canadian immigrants being the principal victims of the disease. Fortunately, by the intervention of the United States government, at the request of the Board, in September, 1885, quarantine was established upon the frontier, and the disease was mainly limited to Montreal and its immediate neighborhood. In the few cases in which it appeared in Massachusetts the disease was traced to direct or indirect communication with Canada, and by the careful supervision and sanitary regulations of the local authorities its appearance was confined to the first cases which occurred. The enactment of a law in 1883, providing for the notifying of the State Board by local authorities of the occurrence of cases of small-pox, has rendered valuable assistance to the Health Department in its investigation of such cases.

Typhoid fever, which is a disease of frequent occurrence in country districts without a public water supply, has also been a subject of careful investigation, and when outbreaks of considerable severity have occurred the health officers have visited such localities, made investigations as to the causes of the disease, caused analyses of the drinking waters to be made, distributed circulars conveying information upon the subject, and given such advice and suggestions as each case required.

The same course has also been pursued with relation to diphtheria, intermittent fever and other diseases, all of which have received special attention, and have also been the sub-

ject of discussion in the papers presented by physicians and other experts upon public health matters in different sections of the State.

The prevalence of trichinosis in pork offered for sale in Massachusetts has also been a subject of investigation by the Health Department, and inquiries have been made in each year with reference both to its extent in swine and also as to its effect upon the health of the people.

The Board has been called upon to give frequent advice with reference to the drainage and sewerage of municipalities, and such requests have been complied with, in many instances the Board having visited the locality in question and made personal observations upon the general question of the advisability of such public works.

Among the important questions of this nature considered by the Board were the drainage of the Mystic, Charles River and Blackstone valleys, which are specially referred to in the sanitary appendix to the Third Annual Report of the Board.

Among the duties defined in the by-laws of the Board as required of its health officers is the sanitary supervision of the public institutions. All such institutions which have been under the supervision of the Board have been visited, many of them quite frequently, by the health officers of the Board, and advice and suggestions given relative to the water supplies, drainage, ventilation, food supplies, arrangement, location and construction of hospital buildings, and management of infectious diseases.

All of these subjects have been reported to the Board at its meetings in the regular monthly reports of the health officers, together with all important matters of a sanitary nature which have required the attention of the department. In addition to these subjects during the past three years, the reports of the analysts of the Board, including all its work relative to the inspection of food and drugs, have also been incorporated with those of the health officer.

MAY 31, 1886.

The following table will be found useful in the interpretation of the centigrade temperatures given in the Reports of the Analysts: —

Table of Thermometric Equivalents according to the Centigrade and Fahrenheit Scales.

Given. C. Sought. F. $n^\circ \text{ C.} = \frac{9n^\circ}{5} + 32$				Given. F. Sought. C. $n^\circ \text{ F.} = \frac{5(n^\circ - 32)}{9}$			
C.	F.	C.	F.	C.	F.	C.	F.
—20.	—4.	10.6	51.	40.6	105.	70.6	159.
—19.4	—3.	11.	51.8	41.	105.8	71.	159.8
—19.	—2.2	11.1	52.	41.1	106.	71.1	160.
—18.8	—2.	11.7	53.	41.7	107.	71.7	161.
—18.3	—1.	12.	53.6	42.	107.6	72.	161.6
—18.	—0.4	12.2	54.	42.2	108.	72.2	162.
—17.8	0.	12.8	55.	42.8	109.	72.8	163.
—17.2	1.	13.	55.4	43.	109.4	73.	163.4
—17.	1.4	13.3	56.	43.3	110.	73.3	164.
—16.67	2.	13.9	57.	43.9	111.	73.9	165
—16.1	3.	14.	57.2	44.	111.2	74.	165.2
—16.	3.2	14.4	58.	44.4	112.	74.4	166.
—15.6	4.	15.	59.	45.	113.	75.	167.
—15.	5.	15.6	60.	45.6	114.	75.6	168.
—14.4	6.	16.	60.8	46.	114.8	76.	168.8
—14.	6.8	16.1	61.	46.1	115.	76.1	169.
—13.9	7.	16.7	62.	46.7	116.	76.7	170.
—13.3	8.	17.	62.6	47.	116.6	77.	170.6
—13.	8.6	17.2	63.	47.2	117.	77.2	171.
—12.8	9.	17.8	64.	47.8	118.	77.8	172.
—12.2	10.	18.	64.4	48.	118.4	78.	172.4
—12.	10.4	18.3	65.	48.3	119.	78.3	173.
—11.7	11.	18.9	66.	48.9	120.	78.9	174.
—11.1	12.	19.	66.2	49.	120.2	79.	174.2
—11.	12.2	19.4	67.	49.4	121.	79.4	175.
—10.6	13.	20.	68.	50.	122.	80.	176.
—10.	14.	20.6	69.	50.6	123.	80.6	177.
—9.4	15.	21.	69.8	51.	123.8	81.	177.8
—9.	15.8	21.1	70.	51.1	124.	.81.1	178.
—8.9	16.	21.7	71.	51.7	125.	81.7	179.
—8.3	17.	22.	71.6	52.	125.6	82.	179.6
—8.	17.6	22.2	72.	52.2	126.	82.2	180.
—7.8	18.	22.8	73.	52.8	127.	82.8	181.
—7.2	19.	23.	73.4	53.	127.4	83.	181.4
—7.	19.4	23.3	74.	53.3	128.	83.3	182.
—6.7	20.	23.9	75.	53.9	129.	83.9	183.
—6.1	21.	24.	75.2	54.	129.2	84.	183.2
—6.	21.2	24.4	76.	54.4	130.	84.4	184.
—5.6	22.	25.	77.	55.	131.	85.	185.
—5.	23.	25.6	78.	55.6	132.	85.6	186.
—4.4	24.	26.	78.8	56.	132.8	86.	186.8
—4.	24.8	26.1	79.	56.1	133.	86.1	187.
—3.9	25.	26.7	80.	56.7	134.	86.7	188.
—3.3	26.	27.	80.6	57.	134.6	87.	188.6
—3.	26.6	27.2	81.	57.2	135.	87.2	189.
—2.8	27.	27.8	82.	57.8	136.	87.8	190.
—2.2	28.	28.	82.4	58.	136.4	88.	190.4
—2.	28.4	28.3	83.	58.3	137.	88.3	191.
—1.7	29.	28.9	84.	58.9	138.	88.9	192.
—1.1	30.	29.	84.2	59.	138.2	89.	192.2
—1.	30.2	29.4	85.	59.4	139.	89.4	193.
—0.6	31.	30.	86.	60.	140.	90.	194.
0.	32.	30.6	87.	60.6	141.	90.6	195.
0.6	33.	31.	87.8	61.	141.8	91.	195.8
1.	33.8	31.1	88.	61.1	142.	91.1	196.
1.1	34.	31.7	89.	61.7	143.	91.7	197.
1.7	35.	32.	89.6	62.	143.6	92.	197.6
2.	35.6	32.2	90.	62.2	144.	92.2	198.
2.2	36.	32.8	91.	62.8	145.	92.8	199.
2.8	37.	33.	91.4	63.	145.4	93.	199.4
3.	37.4	33.3	92.	63.3	146.	93.3	200.
3.3	38.	33.9	93.	63.9	147.	93.9	201.
3.9	39.	34.	93.2	64.	147.2	94.	201.2
4.	39.2	34.4	94.	64.4	148.	94.4	202.
4.4	40.	35.	95.	65.	149.	95.	203.
5.	41.	35.6	96.	65.6	150.	95.6	204.
5.6	42.	36.	96.8	66.	150.8	96.	204.8
6.	42.8	36.1	97.	66.1	151.	96.1	205.
6.1	43.	36.7	98.	66.7	152.	96.7	206.
6.7	44.	37.	98.6	67.	152.6	97.	206.6
7.	44.6	37.2	99.	67.2	153.	97.2	207.
7.2	45.	37.8	100.	67.8	154.	97.8	208.
7.8	46.	38.	100.4	68.	154.4	98.	208.4
8.	46.4	38.3	101.	68.3	155.	98.3	209.
8.3	47.	38.9	102.	68.9	156.	98.9	210.
8.9	48.	39.	102.2	69.	156.2	99.	210.2
9.	48.2	39.4	103.	69.4	157.	99.4	211.
9.4	49.	40.	104.	70.	158.	100.	212.
10.	50.						

THE METRIC SYSTEM.

Length.

1 Myriameter, . .	. Mm.	. (10,000 m.)	. = 6.2137 miles.
1 Kilometer, . .	. Km.	. (1,000 m.)	. = 0.62137 miles.
1 Hectometer, . .	. Hm.	. (100 m.)	. = 328.0833 feet.
1 Decameter, . .	. Dm.	. (10 m.)	. = 393.7 inches.
1 Meter, . . .	. m.	. (1 m.)	. = 39.37 inches.
1 Decimeter, . .	. dm.	. (0.1 m.)	. = 3.937 inches.
1 Centimeter, . .	. cm.	. (0.01 m.)	. = 0.3937 inch.
1 Millimeter, . .	. mm.	. (0.001 m.)	. = 0.03937 inch.

Surface.

1 Hectare, . . .	. Ha.	. (10,000 sq. m.)	= 2.471 acres.
1 Are, . . .	. a. .	. (100 sq. m.)	. = 119.6 square yards.
1 Centare, . . .	. ca.	. (1 sq. m.)	. = 1.550 square inches.

Capacity.

1 Kiloliter or Stère,	. Kl. or st.	(1,000 l.)	. = 1.308 cubic yards,	= 264.17 gallons.
1 Hectoliter, . .	. Hl.	. (100 l.)	. = 2bush. and 3.35 pecks,	= 26.417 gallons.
1 Decaliter, . .	. Dl.	. (10 l.)	. = 9.08 quarts,	= 2.6417 gallons.
1 Liter, . . .	. l. .	. (1 l.)	. = 0.908 quart,	= 1.0567 qts. (1.761 imperial pints).
1 Deciliter, . .	. dl.	. (0.1 l.)	. = 6.1022 cubic inches,	. = 0.845 gill.
1 Centiliter, . .	. cl.	. (0.01 l.)	. = 0.61022 cubic inch,	. = 0.338 fluid ounce.
1 Milliliter, . .	. ml.	. (0.001 l.)	. = 0.061 cubic inch,	. = 0.27 fluid drachm.

Weight.

1 Millier or Tonneau,	M. or T.	(1,000 Kg.)	. = 1 Kl. or 1 Cu. m.	. = 2204.6 pounds (avoirdupois).
1 Quintal, . . .	. Q.	. (100 Kg.)	. = 1 Hl. or 0.1 Cu. m.	. = 220.46 pounds.
1 Myriagram, . .	. Mg.	. (10 Kg.)	. = 1 Dl. or 10 Cu. dm.	. = 22.046 pounds.
1 Kilogram, . .	. Kg.	. (1,000 g.)	. = 1 l. or 1 Cu. dm.	. = 2.2046 pounds.
1 Hectogram, . .	. Hg.	. (100 g.)	. = 1 dl. or 0.1 Cu. dm.	. = 3.5274 ounces.
1 Decagram, . .	. Dg.	. (10 g.)	. = 1 cl. or 10 Cu. cm.	. = 0.3527 ounce.
1 Gram, . . .	. g.	. (1 g.)	. = 1 ml. or 1 Cu. cm.	. = 15.432 grains.
1 Decigram, . .	. dg.	. (0.1 g.)	. = 0.1 ml. or 0.1 Cu. cm.	= 1.5432 grains.
1 Centigram, . .	. cg.	. (0.01 g.)	. = 0.01 ml. or 10 Cu. mm.	= 0.1543 grain.
1 Milligram, . .	. mg.	. (0.001 g.)	. = 0.001 ml. or 1 Cu. mm.	= 0.0154 grain.

One kilogram is equal to a weight represented by one liter of distilled water at 4° C. In the centigrade scale 0 (32°+F.) is the freezing point; 100°+ (212°+F.) is the boiling point. Five degrees C. corresponds to nine degrees F.

All measures in the metric system are derived from the meter, and their names express their values. Some of the names in the French system (like our "dime") are not in practical use; e.g., hectometer, decagram, etc.

One inch = 2.5 centimeters nearly; one quart (wine measure) = 0.946 liter; one pound Troy = 0.373 kilogram; one acre = 0.4046 hectare.

MALARIA IN EASTERN MASSACHUSETTS.

MALARIA IN EASTERN MASSACHUSETTS.

An epidemic of malarial fever in eastern Massachusetts calls for more than a passing notice.

The Boylston Prize Dissertation of Dr. O. W. Holmes, published in 1838, was an answer to the question, "To what extent and in what places has intermittent fever been indigenous in New England?" Dr. Holmes gives as his first head, "Testimony of the earlier writers in New England." He points out the fact that the New England States, "included between the latitudes 41° and 48° correspond in their parallels with the pestilential districts of France and Italy." "And in our own country the very general prevalence of the same fevers in the parallel of New England to the west of the chain of mountains by which it is traversed both in the United States and in Canada, is too well known to require any illustration."

Neither, as he says, can we expect to establish any claim to exemption from this disease on the basis of differences of conditions in regard to water, soil, temperature, climate or "agricultural or other changes artificially produced."

Nevertheless it is seen that the proofs of the former existence of intermittents in this part of our country, especially eastern Massachusetts, are very meagre and unsatisfactory in the chronicles of New England during the two hundred years preceding the date of Dr. Holmes's essay.

Dr. Holmes ends his examination of the records in these words: "This closes the testimony which I have found in the earlier authors. So far then as the question can be answered from those records of the first century of New England which I have examined, it would seem that in-

digenous intermittent fever can have prevailed but to a very limited extent, and the only place which we can clearly point to, as giving origin to the disease, is New Haven." *

Dr. Holmes has appended to his dissertation a map of New England, on which "the places where intermittent fever is supposed to have originated are designated by asterisks." East of the Connecticut River the places marked are Pomfret, Conn.; South Kingston, Cranston and Providence in Rhode Island; Hopkinton, Groton, Boston and Newburyport in Massachusetts; Kensington in New Hampshire; Biddeford and Poland in Maine.

It is admitted that the evidence in regard to most of these places is very slight, and often inconclusive. In the case of Providence, R. I., the evidence is sufficient, as in that also of Hopkinton, Mass. And in this connection we note a curious fact. The disease in the last-named locality appears to have been indigenous in the neighborhood of two ponds, situated in the westerly and southwesterly portion of that town. One of these, called North Pond, empties into the Blackstone River, which debouches at Providence, R. I.; while the other, Whitehall Pond, forms one of the largest sources of the Sudbury River which flows through the town of Framingham. The watershed of Whitehall Pond and that of the Blackstone River are nearly identified at one point.

With these exceptions, so meagre is the evidence of the existence of malaria as to give color of authority to the statement, that intermittent fever has never been known in eastern Massachusetts as an epidemic disease † before the year 1885.

Eastward of the Alleghany Mountains the northern boundary of malarial fever as an endemic disease is said to correspond very nearly to the isothermal line of 70° of mean summer temperature. This includes the western half of Long Island, Westchester County, N. Y., and the Hudson

* Dr. Oliver Wendell Holmes, Boylston Prize Dissertations for the years 1836 and 1837. Boston: Charles C. Little and James Brown. 1838. p. 25.

† It is asserted, according to Dr. Holmes, in Mann's Medical Sketches, published at Dedham in 1816, that "intermittent fevers one hundred years ago were common in the lower towns of Massachusetts." Dr. Holmes was, however, unable to cite any positive evidence, documentary or other, in support of this general statement.

River region, as far north as Watervliet Arsenal.* Beyond the line of this, its usual habitat, it has advanced at several distinct periods, chiefly in epidemic form, into western Connecticut and Massachusetts. Year by year it has moved forward, through Connecticut especially, generally following the valleys (not always so, but pursuing a somewhat erratic and irregular course) in a northerly and easterly direction. The first epidemic, of which Dr. Holmes has given us the best account extant, was in 1793 to 1799. In a few localities, New Haven and southwestern Connecticut especially, Sheffield, Mass., the Housatonic and Hoosac River valleys, Northampton and Deerfield on the Connecticut River, and parts of the valleys of the Berkshire Hills where the mean summer temperature approaches 70° F., it has reappeared from time to time in occasional outbursts or has assumed a quasi-endemic character. In the majority of places, however, the epidemic manifestation has disappeared or died out after a few years.

In 1828 to 1836 there was a second epidemic, appearing first in localities previously visited by it, and spreading to new places, still in a north and east direction.

"From 1836–7 to 1850 no cases occurred, so far as known, in any part of New England."

In 1850 it appeared again in New Haven and its vicinity, where it has since remained as an endemic. In 1860 it appeared in southwestern Connecticut, and has since spread slowly, north and east, year by year, until in 1879-80 an epidemic occurred in western Massachusetts, the history of which is most thoroughly detailed in the State Board of Health Report for 1880, by Dr. J. F. Alleyne Adams of Pittsfield, Mass.

The region traversed by the epidemic of 1830 to 1836, and that visited during 1875-80 were similar, although the last was the most extensive of the three epidemics, reaching, on the Connecticut River, even into New Hampshire and Vermont. Amherst, lying east of the Connecticut, was again visited, as in 1836-7.

The nearest place to Framingham, in point of topography,

* "Malarial fever on Long Island: its etiology," by Wm. H. Thayer, M.D., Brooklyn, N.Y.—N. Y. Med. Jour., March 7, 1885.

appears to have been the town of Thompson in northeastern Connecticut in 1880; and in point of time, also, Providence and some other localities in Rhode Island, and some few scattered cases in Middlesex County, Mass., perhaps doubtful, in 1883-4.

Framingham is a town of about 8,000 or 9,000 inhabitants, the number fluctuating somewhat, as is the case in all manufacturing villages. It is situated near the geographical centre of eastern Massachusetts, about 30 miles north of Providence, R. I., 100 miles northeast of New Haven, Conn., and about 70 miles from the Connecticut River, these being the nearest points where malaria may be said to have existed more or less endemically within the present century.

Framingham lies upon the Sudbury River at the point where the three great reservoirs for the additional water supply of the city of Boston are made, dams 1, 2 and 3, and a large part of the area of the basins (850 acres), being within the territory of the town. South Framingham, however, the principal locality of the epidemic, is not on or near any of these artificial bodies of water, but lies on a plane 10 to 30 feet lower in elevation, and is situated within the watershed of Cochituate Lake, rather than in that of Sudbury River. The water stored in these reservoirs, frequently considerably discolored if not contaminated by vegetable decay, is, however, brought into South Framingham by way of Farm Pond, a natural body of water of 165 acres, of no great depth, but which, being the last and lowest of the series of reservoirs, has been utilized as a settling basin until it has become so clogged or contaminated by vegetable matter as to call for its abandonment. In 1881 there was a peculiar fœtid odor in the vicinity of this pond, and a fishy or "cucumber" taste in the water. That part of South Framingham to which this inquiry chiefly relates, lies contiguous to the southern extremity of Farm Pond and contains about one-fourth of the area and about one-fifth of the population of the more closely settled portion of the village. Besides having Farm Pond upon the north, it has upon the south and east broad areas of stagnant swamp and wet meadows, into which the sewage of the whole village finds its way by

gravitation. North of the Boston & Albany Railroad the ground rises, in passing toward the north, to a plateau where a small number, only, of cases of intermittents occurred. The great bulk of the cases was in the small area south of the railroad. The soil is a sandy and gravelly loam, of little elevation, resting upon a subsoil composed of nearly impervious, firm quicksand filled with water. This subsoil of fine sand has a very extensive range, and all three of the reservoir dams are, in part, built upon it as a foundation. The swamps are chiefly composed of a spongy peat, in some places of considerable depth, and which retains the water in stagnant pools. In spite of these unfavorable conditions the place is not unhealthy.*

What is believed by the writer to be the first case of paludal fever of indigenous origin in this region, occurred upon the borders of Sudbury River in 1876, at a point about half-way between the villages of Framingham Centre and Saxonville. For more than two centuries a dam had existed at a fall in the river in this latter village. About 1858 this dam was raised several feet by the Saxonville Mills Corporation, and large areas were covered with a shallow flowage near the point marked A in blue on the accompanying map. During the fall of 1875 and spring of 1876 an attempt was made by the owner, Mr. Michael H. Simpson, to reclaim the meadows in this vicinity. Broad, low dikes were constructed out of the mud of the drowned lands, running perpendicularly to the current of the stream in order to deepen and narrow the flow of the river. For this purpose the water was let off at the dam during the late summer, uncovering wide areas of mud. Forty or fifty men were employed in the work of digging and throwing up the alluvial deposit from the river bed and cutting through the lately submerged land. None of these men, it is believed, suffered in consequence. But in the month of April, 1876, a man residing at A was attacked with a bilious remittent fever of unmistakably malarial type. It appeared that he was in the habit of going down to the river margin early in the morning and

* The prevailing diseases are those of cold, wet soils, such as subacute rheumatism, catarrhal affections, pneumonia, etc., and not especially those due to filth accumulation, such as typhoid and diphtheria.

after sunset in the evening, and that frequently the fogs we heavy at these times. The weather had also been warm f the season.

No more cases are known to have occurred until after th dams were erected by the city of Boston upon the Sudbu and Stony Brook. At the point marked B in blue on Ba 3 on Stony Brook stands a house, in low ground and adj cent to a swamp covered by shallow flowage. Here malar symptoms have appeared at various times since 1880.

In 1883 one case, of local origin, is said to have occurr on the Natick road, two miles east of South Framingham, the point marked C in red.

With these exceptions, it is believed no undoubted c of indigenous malarial fever has arisen, until the epide of 1885. Imported cases have, however, been know For perhaps a year or more before the epidemic outbre a habit of periodicity or intermittence has been remarked many diseases, and the use of quinine had largely increas One apothecary in Framingham assures the writer that more than a year he has had such frequent calls for t drug that he has sold one thousand quinine pills where formerly sold one hundred, and that he has ordered fr the wholesale dealers one pound of quinine where formerly ordered one ounce. Evidence from other sour is at hand, showing the increased use of this medicine.

Though perhaps having no bearing upon the subject, it proper to note the fact of a malignant and fatal epidemic dysentery occurring in one part of the town in 1866; to note further, that typhoid fever* prevailed to so extent in South Framingham during the epidemic of mala in 1885, while consumption has been, of late years, l fatal than formerly.

The first case reported in the epidemic now under co sideration occurred in South Framingham, north of th Boston & Albany Railroad, on June 11, 1885. The p tient stated that he had experienced similar symptoms the summer of 1884. The evidence seems to show that th case was indigenous. It was of tertian type and modera severity.

* Said to be milder and less frequent when malaria is present.

On July 4 two severe cases were seen. One of these, being perhaps imported, is omitted in the enumeration. July 8, one case; July 22, four cases; and between that date and October 1 one hundred and ninety-six cases are reported. It is known, also, that an uncertain number of cases occurred which were not seen by any physician,—patients taking quinine upon their own responsibility, or by the advice of friends.*

Perhaps no benefit could be derived from presenting in tabular form all the cases as reported. A general statement, drawn from a careful study, examination and comparison of the various records, and from the observations of he different physicians of the town who saw the cases, will ive a sufficiently accurate picture of the epidemic. A map nexed shows, in red, the precise locality visited, † and, in ue, the portions of territory where swamps, drowned nds, stagnant water, etc., are found. By far the greater mber of cases occurred during the month of August, and subsidence of the outbreak was observed about the middle September.

All ages were attacked, from babies of one month to eople over eighty years old. There were some cases in regnant women, but no miscarriages reported as resulting om this cause. Neither was the unborn child affected in ny observed instance.

The type of fever was generally tertian, rarely quotidian, nore rarely still quartan. In a great many cases,—precise ata not obtainable,—there were only two or three chills, nd frequently only one chill was experienced. One patient ied,—a woman over eighty years of age and infirm,—eath resulting, very likely, from some other cause.‡ An talian, a laborer upon the new conduit through Farm Pond, vas sent away, together with several companions, suffering rom the fever, and is reported to have died subsequently, it Tewksbury or some other State institution.

A small proportion only of the cases relapsed, or suffered rom prolonged anæmia and debility resulting from ague.

* Numerous cases are known to have occurred in the adjoining towns.

† The red dots upon the map indicate the situation of separate houses where alaria occurred.

‡ She refused all treatment.

There were some cases of a latent character, with splenic enlargement, etc., not included in the above enumeration, and at least one case of severe congestive chills. Rigors have been very severe and marked in nearly all cases, and nausea and vomiting occurred in about seventy-five per cent. of those attacked. Pallor about the mouth and a shrunken or parboiled appearance of the fingers was observed in some cases during the period of intermittence. Quinine has seemed to be immediately effective in checking or mitigating the disorder.

For several days preceding the initial chill there was complaint of malaise, and occasionally of chilliness and aching of the bones.

The chills lasted a variable time, rarely longer than two hours, the temperature in the axilla rising frequently to 105° F., and in some instances higher. Patients shook so as to jar the bed, and even the floor and furniture of the room. The lips became purple, fingers shrunken and nails blue. The succeeding hot stage was very severe and almost unendurable. The sweating, which followed in every case, continued often until late into the night. On the next day the patient appeared and expressed himself as feeling as well as usual, though languid and disinclined to exertion or work. The tendency to relapse on the eighth, fourteenth or twenty-first days was rarely, if ever, remarked. Vomiting, during and after the fit, as well as at the beginning, was rather a frequent symptom. Recovery in nearly all cases except the relapsing ones was rapid and complete.

These details are given to show that the diagnosis, as a rule, was easy and certain.

The area marked in red, in the accompanying map, includes about two hundred acres, one-half, at least, of which is bog and swamp, and therefore not built upon nor habitable. Within this area, by actual count, are seventy-two houses. Malaria is known to have existed in fifty-one of these, and in many houses, containing more than one family, every individual was attacked. It will be remarked that this area is, as it were, cut in two by the Chestnut Hill Conduit of the Boston Water Supply, to which fact attention will be called further on. It cannot escape attention, also, that this area is

surrounded on all sides by wet meadows, swamps and swampy woods.

Origin of Malarial Epidemics.

The modern theories of the etiology of diseases, and especially the germ theory, must compel us to recast our views of the origin of malarial fever.

Whoever pretends that malaria arises *de novo* from the conjunction of heat, moisture and vegetable decay, although supported by the evidence of competent observers in many countries, and by the great weight of authority of the best medical and sanitary writers, who recognize these three as essential factors, must encounter many strange and inexplicable contradictions, and find himself compelled to show, not that under certain conditions of soil-moisture and temperature malaria had undoubtedly arisen, but to explain why, under precisely similar conditions in countless instances for a long series of years, it may be a century, this disease has been unknown in localities where it has suddenly appeared as an epidemic.

On the other hand, he who denies, *in toto*, that these three factors have any agency whatsoever in the etiology of ague, is forced to admit that his chief arguments are based upon exceptions and negations, and that a single positive fact may scatter them to the winds.

It is believed by the writer that the epidemic at Framingham offers an unexampled opportunity for the study of the natural history of malaria.

The connection of intermittents with the erection of dams, especially upon winding streams, having broad margins of meadow and wooded swamp, where the flow is impeded and the water becomes stagnant and the land "drowned," this connection is well known; while instances are numerous enough not to require citation, where, not only in other countries and along our western rivers, but here in New England, the disappearance of malaria has been with undoubted justice attributed, not to time alone, but to the removal of dams and obstructions, and the draining and cultivation of wet lands.

It is unnecessary to quote the opinions of writers, sanitary

and medical, upon this point. We must admit the value of such testimony. But in order to narrow the question somewhat, and to give this paper a local character, a table is annexed showing the views entertained by the various observers of previous epidemics in Massachusetts, taken from the admirable essays on this subject of Drs. Holmes and Adams, to which reference has been already made.

We will now pass to a consideration of the conditions in Framingham.

At the close of the year 1874, the city of Boston decided to take the Sudbury River as an additional water supply, and for this purpose began the work of excavating for three large dams upon that river and one of its principal tributaries called Stony Brook. Soon after, work was begun upon a conduit from Farm Pond to Chestnut Hill Reservoir. In constructing the dams, the river was diverted and its old bed laid open to the sun and air. Great quantities of alluvial mud were exposed and dug up in every direction. The excavations for the foundations of the dams were deep and extensive, long wings being required by the porous nature of the soil. This work was chiefly done in the summer. The foundations were in some cases twenty or thirty feet in depth. The men who performed this work lived in miserable barracks or shanties, temporarily put up as near to the places of labor as possible. They drank the water of the more or less stagnant river, and passed their days and nights in the midst of its mud and fogs.

The Chestnut Hill Conduit was constructed directly through and upon the meadows supposed to be the seat or nidus of the malarial infection of the epidemic of 1885. Here again very extensive upheavals and removals of muck and marsh deposit were made, it being necessary to find below the ooze a solid basis upon which to build. * The peat and mud were removed from the whole width of the cutting and replaced by gravel, or when no firm bottom could be reached, as happened in parts of Guinea Meadow (the swamps in question), piles were driven and planking laid. A more extensive and thorough turning up of wet and decaying vegetable matter (more or less mixed also with the sewage of the neighboring

* In one case the mud was removed to a depth of twenty feet.

village, which gravitates to this meadow), it would be difficult to conceive of.

Several hundred men were employed upon this construction, there was quite a numerous population in the territory north of the line, and scattered houses in every direction. Much of the work was done in the summer, the time of drought and small rainfall, when the water was lowest in the meadows. These are drained by Beaver Dam Brook, a sluggish, obstructed stream, having a slow water-shed of three thousand acres.

Here then were present in the highest perfection in the precise locality of the epidemic of 1885 in South Framingham, the conditions assigned as the probable cause of malaria in cases numbered 4, 5, 6, 13, 30, 35, 37, 39, 42, 46, 48, 50, 53, 57 in Massachusetts,* besides numberless instances in this and other countries where epidemics have been attributed, by competent observers, to digging and removing the soil in the construction of streets, sewers, etc., etc.

All the work above described was completed at least *seven years before* the epidemic appearance of intermittent fever in Framingham.

The summers of 1870–71 were periods of drought and low wells, and also those of the years 1877–78–79–80, and especially 1883, when the total fall of water in June, July, August and September was only about half that of 1882 and 1885. This condition has been cited by some observers as having a connection with malaria.

Much of the picturesque beauty of Framingham, for which it is so justly celebrated, is due to the many pieces of water which meet the eye at every turn. Besides the larger lakes and the river Sudbury, which winds through the middle of the town from the southwest corner to the northeast, there are numerous smaller ponds, streams and brooks; some of the latter being winding and stagnant, others rapid and quick. These, in spring freshets, are apt to rise and overflow their banks and cover the meadows in all directions. Several times within the memory of the writer, such a freshet has occurred upon Stony Brook and the Sudbury River and their tributaries, tearing away culverts and roads, choking up the

* See tables.

natural drainage of meadows with vast quantities of gravel and silt, and leaving behind pools of stagnant water, which, having no outlet and escaping chiefly by evaporation, remained green, slimy and festering, far into the summer. In the end of March, 1876 (the year of the commencement of the work of construction of dams by the city of Boston), such an overflow took place. This condition has been assigned frequently as one of the contributory causes of epidemics of malaria. See numbers 24, 30, 32; also, at Springfield, Holyoke, and other places in Massachusetts.

In 1872, Lake Cochituate became very low, and in order to draw water into it from Farm Pond and the Sudbury River, a connection was made by means of an artificial ditch or canal discharging into Beaver Dam Brook, which was, however, abandoned the next year. It was again opened in 1875 and used until 1878, when the connection with Farm Pond was completely severed, and, the brook being obstructed, this canal became stagnant and has since remained so. It receives the drainage of perhaps forty houses, and its wooden sides have fallen in. It is especially in the vicinity of this stagnant ditch that malaria has been rife during the epidemic. It is proper to remark that this condition of things has been in existence since 1879. Of variations purely atmospheric there is little to say. The mean summer temperature of 67°–68° remained unchanged in 1885. In the months of August * and September the days are apt to be very hot and the nights cool, damp and foggy, especially in low grounds and near streams or meadows. The Guinea Meadows contained rather more stagnant water than is usual throughout the summer, in 1885, but the difference was not material. The rainfall during the last days of July and in August of that year (the time of especial prevalence of malaria) was unusually great, — 7.34 inches in thirty days. If this had any effect whatever, such a rainfall must have acted, we should suppose, to abate the epidemic influence. The interesting fact is noted, however, that on the days immediately succeeding a heavy rain an increase in the number of fever cases was observed, suggesting a direct connection of cause and effect.

* August, 1885, was exceptionally cold.

But it is pre-eminently in and around the reservoirs and dams of the Boston Water Works that those precise conditions prevailed which are assumed to have direct association with the origin of malarial epidemics. Saturation of soil and vegetable decay, foul exhalations and effluvium arising from organic matter decomposing in connection with heat and moisture, the effect of the sun upon "drowned lands," associated usually with the presence of dams and artificial reservoirs of water, these are suggested or referred to in some way or at some time, in explanation of the appearance of intermittents in twenty-five of the thirty towns enumerated in the accompanying table.

In Framingham, as has been already said, about 850 acres are occupied by these reservoirs. The town covers say 14,000 acres, of which more than half, being on a much higher level, we may assume to be beyond the reach of any malarial influence arising from this source. About one-eighth then of the area of the town liable to be affected, whether by soil-water or by exhalations from these basins, is covered by the flowing of the reservoirs when the dams are closed. The Sudbury River watershed is much of it low and covered with wood and bog, and, when raised, the water covered lands which had been farmed and manured for a century. The water had always a yellow color and a pondy taste in consequence.

In 1878–79 the wood was cut and the brush removed, leaving, however, large areas of swamp, covered with stumps and muck, to await the slow processes of chemical change. The dams were completed and the basins allowed to fill. In 1881, during the late summer, the season having been a very dry one, Basin No. 3, containing by far the largest area of flowage, fell so as to expose one-half or two-thirds of its surface, which was largely composed of swamp, covered with rotting stumps of trees, black mud and decaying vegetation. The peculiar effluvium of "drowned land" was almost insupportable in its vicinity. This had been submerged more or less constantly for more than two years. A rank vegetation of fungi and sphagnum appeared. Marsh gas could be seen bubbling up in the stagnant pools. The same condition of things again occurred in 1883, after two years' sub-

mergence. In this latter case everything was exposed except the bed of the original stream.

In Basin No. 2, in 1883 and 1884, after four or five years' submergence, the water was drawn down in the same thorough manner, and much work was done in clearing out the mud from the bottom, filling up "dead-ends," etc. Large quantities of muck were removed and placed upon the shores.

Basin No. 1, of very shallow flowage, was often very low and smelled badly, but was never drawn so completely down as the others. The water in the gate-houses gave out a strong sulphuretted-hydrogen smell at all times.

Farm Pond was drawn down seven feet in 1881, and a temporary ditch or channel was made around its edge, connecting the conduits independently. At that time its water had the "cucumber" taste already spoken of and was offensive to the smell. "Professor Ira Remsen, of Baltimore, attributed the objectionable taste to the presence of a species of fresh-water sponge, which was found in small quantities on the gravelly or stony parts of the bottom of the pond." "After a short time the bad taste in the water of the pond disappeared." * In 1884, Farm Pond was drawn down two feet, and in 1885 four feet, in order to construct the new conduit marked upon the map, and the southwest portion, being nearly cut off from the rest of the pond, became covered with a rank growth of grass and weeds. There was, however, no complaint of any foul odor from this pond during 1885.

In Basin No. 3, in 1879 (the year of first flowage), the water was contaminated by a growth of minute algæ, similar to that found in the Mystic River supply. The temperature of the air was high at the time of its appearance, and that of the water especially so, occasionally being even warmer than the air, and this at a depth of twenty feet, which, of course, suggested chemical action as its cause.

Speaking of these algæ, Mr. Fteley says: "These minute plants, which appear to be uniformly distributed throughout the water, flow with it, and are of such small bulk that they cannot be separated by screens; the wind has a notice-

* "Additional Supply from Sudbury River," by A. Fteley, Resident Engineer, Boston Water Works, Boston, 1882.

able effect on them, and often blows them towards the lee shore, where they accumulate and form a solid scum of a sharp green color. When in the fresh state, they emit a very peculiar musty odor; if stranded by the action of the wind they soon decay and form a bluish-green mass, which develops a smell as of organic matter in the process of decomposition. Of the formation of the algæ, or of their origin, little is known; but it is remarkable that they appear very suddenly, and in large quantities; shallow flowage, it is said, favors their development, probably on account of the higher temperature which the water attains in such conditions when heated by the sun; but they are formed very rapidly, also, in deep water. I have observed several times that large quantities appeared in a very short time equally distributed through hundreds of millions of gallons of water, twenty feet deep, several hundred feet from any shore, and in very calm weather. . . . The formation of the algæ appears to follow the temperature of the water, increasing and diminishing with it."

These algæ appeared in Basin No. 1 in 1880, but have since nearly or entirely disappeared.

It is only necessary to add to the above description, that the peculiar sickening effluvium arising from the decay of these minute organisms was distinctly perceptible in the air at a considerable distance from the reservoirs.

It seems unnecessary to follow this vein of investigation any further. It suffices to say, that for nine years the three factors of heat, moisture and vegetable decay, which, it is assumed, can *de novo* produce malaria, have been present in the greatest activity in Framingham, while none, or rare and doubtful, cases of intermittent fever have arisen; whereas, in the summer of 1885, during an epidemic of the disease, few, if any, cases appeared in the vicinity of the great reservoirs and dams, where the three factors had been present in the highest degree.

But, on the other hand, to deny *in toto* the agency of heat, moisture and organic decay in the development of malaria is to utterly reject the evidence of experience and observation. The germ theory enables us to reconcile these conflicting opinions.

All organic life requires these three elements for its growth and propagation, and the higher the development of the organism, the more of these it requires. Hence we may conclude that the malarial germ is a living thing and somewhat highly organized. It cannot be simply chemical, nor magnetic or telluric. That it differs essentially from the so-called zymotic ferments may be assumed from the fact that in the human organism a first attack does not procure immunity from a second, and that certain races of men, as well as certain individuals, show little susceptibility to its influence. Its natural history, too, seems to be more open to study and observation than that of most of the germs of infectious diseases.

It would appear that the malarial germ requires stagnant water for its growth and development. It will not live in running streams, nor in large moving bodies of water. If you drain the water from the swamps where it exists, and cultivate, that is aerate, the soil, you destroy the germ. You do not draw it into a new location, you kill it outright. Whether this results from mechanical or from chemical causes we will not stop to inquire.

The germ has a certain weight and size; it obeys the laws of gravitation, is blown about by winds, and is stopped by obstacles. It requires a certain temperature, and is benumbed, possibly killed, by cold. It is true these statements admit of question, but they are not mere assumptions. They are gathered from the study and observation of a host of facts, collected by competent scientists.

As to the question of the spontaneous disappearance of malaria, this, like its epidemic appearance, we cannot explain; but the same is true of all the germs of epidemic and zymotic diseases, which present this characteristic. A detailed account has been given above of the sudden appearance and disappearance of the anabœna, a species of algæ, in the water of the reservoirs. Here is an organism of easy identification, found swarming in the water, and then going out of existence, unaccounted for, without known origin or cause, its only condition of existence being a rather high water temperature. A similar, but not identical, growth has been discovered in another artificial reservoir many miles

away, and having no known connection with the Sudbury basins. Many grosser pests, familiar to agriculture, have this character of periodicity of appearance and disappearance, among which may be cited the seven-year locusts, the canker-worm, the blight, the rose-bug, and many others.

By what avenues is the malarial germ introduced? Two methods suggest themselves; namely, rain-storms and underground water. Malaria is supposed to rise and be carried to and fro in fogs and mist. This may account for its introduction through the medium of clouds and rain. Thus may occur those occasional appearances of malaria upon high ground far removed from any swamps or meadows.

But the underground movement of water is a factor which has not, perhaps, been sufficiently considered in this question. How often can we know the source of water in deep wells? Many wells are known to remain full in long droughts, or to fill suddenly without the actual presence of rain-storms. There are springs in this country, called "barometric," that, running dry, burst forth and flow in full volume many hours before any rain is seen to fall in their immediate vicinity. Whence comes the head of water, unless it be a fall of rain which has saturated the earth and reached the underflow at some considerable distance away?

What do we know of the extent of the substratum of quicksand of varying depth and full of water, found everywhere, it is believed, in Framingham, and extending indefinitely beneath the soil in the adjacent towns? That this is something more than an underground lake of vast extent is very probable. It is believed by many that this water has a certain gradual and imperceptible flow. Whence and whither, we cannot say.

Professor Cantani * believes that the malarial parasite enters into the blood more frequently by way of the stomach than by the respiratory tract. That drinking water is the vehicle of the infection more surely than any other means. It is uncertain if it ever enters by the air alone. He suggests, also, that vegetables or fruits which ripen upon the ground may introduce it into the human stomach in some cases.

* Medical Clinic — Ospitale Gesu e Maria, monthly supplement of the Gazetta dagli Ospitali, Naples, June, 1885.

Tabular Statement of Outbreaks of Malarial Fever in New England—Continued.

No.	Place.	Date.	Assumed Cause.	Conditions.	Observer.	Author.
13	Sheffield,	1800	Dam,	"Bottom frequently covered and afterwards exposed to a hot sun,"	Dr. Oliver Peck,	Dr. Holmes.
14	Bush's Pond,	-	Dam,	"Intermittents were very frequent till the dam was taken away,"	" "	"
15	Housatonic R.,	1827-8	Dam,	Intermittents prevailed until the dam was lowered by order of the courts,	" "	"
16	Great Barrington,	-	Peculiar effluvium,	"Alternate covering with water and exposure to the sun,"	" "	"
17	Pittsfield,	1780-90	Mill-dam,	"The sickness ceased soon after the destruction of the dam,"	. . . . . .	"
18	"	-	Indigenous,	. . . . . .	. . . . . .	"
19	"	1837	. . . . . .	In consequence of the removal of a dam malaria became prevalent,	Dr. Childs,	"
20	Northampton,	1792	Dam, S. Hadley Canal,	Dam removed aud canal deepened; the disease disappeared in consequence,	Dr. Charles Seegar,	"
21	"	-	Probably indigenous,	. . . . . .	. . . . . .	"
22	Deerfield,	1793-4	Dam,	Disease subsided on the draining of the meadows,	. . . . . .	"
23	"	-	Probably indigenous,	. . . . . .	. . . . . .	"
24	"	-	Stagnant water and miasmata,	Subsidence of water from overflowed meadows,	Various physicians,	"
25	Amherst,	-	Mill-dams,	. . . . . .	. . . . . .	"
26	Hadley,	1836-7	Offensive smell from vegetable decay,	Drying off a mill-pond,	. . . . . .	"
27	W. Stockbridge,	1791	Dam,	Locality became notorious for intermittents. Wooded land submerged,	. . . . . .	"
28	Housatonic R.,	1802	Dam,	. . . . . .	. . . . . .	"

29	Greenfield, . .	1805	Dam and stench, . . .	Drawing off a mill-pond in spring. Stench insupportable. Epidemic dysentery prevailed in 1802, ...	Dr. Stone, . . .	Dr. Holmes.
30	Sheffield, . .	1877-80	Mill-pond; dry season, . .	"Developed from the exposure of soil habitually under water." Spring freshets. Low condition of wells, ...	Dr. W. P. Small, .	Dr. Adams.
31	" . .	1879-80	Drinking-water, . . .	"The only traceable cause lay in the well from which the family drank,"	" " . .	"
32	New Marlboro', .	1874-80	Stagnant water, . . .	Freshet in spring. Stagnant, slimy pools of water evaporating in hot, dry weather, ...	Dr. Seth Pease, . .	"
33	Otis, . . .	1880	Ponds and reservoir (?) .	"No season is exempt." Developed in other places besides vicinity of reservoir. Probably indigenous, ...	Dr. C B. King, . .	"
34	Great Barrington,	1879-80	Dam of Berkshire woollen mill, ...	Has existed for forty years. Drawn down every day in summer,	Dr. Samuel Camp, .	"
35	" "	1880	Drinking swamp water, and working in a swamp below the dam, ...	. . . .	Dr. W. H. Parkes, .	"
36	Lee, . . .	1880	Dams and reservoirs, . .	Swamps on the Housatonic River. Disease unknown here for fifty years, ...	Several physicians, .	"
37	Lenox, . . .	1878-80	Dam and vegetable decay, .	Malarious district exactly coextensive with that part of the river which forms the reservoir. Bottom exposed covered with the black and rotting remains of stumps and bushes. Land in a soggy and drowned condition, ...	Dr. R. C. Greenleaf, .	"
38	W. Stockbridge, .	1880	Reservoir and swamp, . .	First appearance in eighteen years.		
39	Richmond, . .	1879-80	Reservoir an swamp. Stench, ...	"When they dry up they smell very badly, and I notice that more sickness follows s' on."		
40	Pittsfield, . .	1880	Intermittent fever unknown become low in summer, were unusually low the occurred in their vicinity,"	here since 1836. The town contains two large reservoirs which "exposing large surface covered with decaying stumps. These past season, but no cases of chills and fever are known to have	. . . . .	"
41	Lanesborough, .	1879-80	Dam raised within a few years, ...	Mild quotidian. Area of bottom, exposed in warm weather, covered with rotting stumps, etc., ...	Dr. Thayer, . .	"

Tabular Statement of Outbreaks of Malarial Fever in New England—Concluded.

No.	Place.	Date.	Assumed Cause.	Conditions.	Observer.	Author.
42	N. Adams, . .	1880	Undrained swamps, . .	Typhoid fever much less prevalent, it is said, during past ten years than formerly, ...	Various physicians, .	Dr. Adams.
43	Longmeadow, .	1880	Cases occurred on high and March, ...	dry land. No swamps nor reservoirs. First cases occurred in	. . . . . .	"
44	Agawam, . .	1880	A general epidemic similar denly about the end of Sep	to that of Framingham. Began about August 1; ended sud-tember, ...	Dr. Ufford, . . .	"
45	Springfield, . .	1875-80	Epidemic, ...	Summer. Unknown "for more than a century." (Similar to that of Framingham.) Prevailed on low grounds and newly made streets, ...	Dr. P. L. B. Stickney and others, . .	"
46	W. Springfield, .	1879-80	Low lands, ...	Chiefly confined to a strip of land bordering the Connecticut River. Those who worked on low grounds, but lived on high land, have had it, while their families have escaped entirely, .	Dr. U. H. Flagg, . .	"
47	Chicopee, . .	1879-80	Mill-ponds and dams, . .	Dry season and low water. Some of the worst cases were near the outlet of a sewer, ...	Dr. D. H. Motting, .	"
48	" . .	1879-80	Digging in wet lands while laying sewers may have produced it, ...	. . . .	Dr. H. G. Forbes, .	"
49	Holyoke, . .	1875-80	Ashley Pond; a water supply,	All the families in that vicinity were affected. Type, quotidian,	Dr. J. J. O'Connor, .	"
50	" . . .	1880	Indigenous, ...	Near swamps and pond. Dam raised two or three years ago. Other conditions same as for twenty years past, . . .	Dr. C. Blodgett, . .	"
51	Southwick, . .	1880	. . . .	Eight cases in June, July, August and September. None near swamps, but on sandy loam soil, ...	Dr. J. W. Rockwell, .	"
52	Brimfield, . .	1879-80	Cold, wet land, . . .	Tertian. Occurred "mostly in winter"; on high land, but the locality is wet and swampy, ...	Dr. G. F. Chamberlain,	"
53	So. Hadley, . .	1880	Near water-course, . .	Draining large swale lands. Began in August. Three cases, far apart, were on high and dry land, ...	Dr. H. A. Deane, .	"

54	Northampton, .	1879-80	"Extremely obscure," . .	Summer. Large number of cases in neighborhood of a dam and saw-mill. Low water and bad drainage cannot account for it,	Dr. C. Seymour, . .	Dr Adams.
55	Easthampton, .	1880	Vicinity of dams, ...	Last of July. "Reservoirs and streams have been unusually low." "Appeared in other and distant parts of the town," .	Dr. J. W. Winslow, .	"
56	Hadley, . . .	1879-80	Dams; low water, . .	The pond has existed for two hundred years. Water has been unusually low during the season, ...	. . . . . .	"
57	Hatfield, . .	1879-80	Vicinity of low ground and a brook, ...	Summer. The land has been cultivated for twenty years. A reservoir three miles away had only one case near it, . .	. . . . . .	"

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48	" . .	1879-80	Digging in wet lands while laying sewers may have produced it, ...	. . . .	Dr. H. G. Forbes, .	"
49	Holyoke, . .	1875-80	Ashley Pond; a water supply,	All the families in that vicinity were affected. Type, quotidian,	Dr. J. J. O'Connor, .	"
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55	Easthampton, .	1880	Vicinity of dams, ...	Last of July. "Reservoirs and streams have been unusually low." "Appeared in other and distant parts of the town," .	Dr. J. W. Winslow, .	"
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MASSACHUSETTS CITIES AND TOWNS.

THE

WEEKLY MORTALITY REPORTS OF MASSACHUSETTS CITIES AND TOWNS.

The present summary is compiled from the reports forwarded to the office of the Health Department from about one hundred cities and towns, these reports being made up to the close of each week. They comprise the mortality statistics of about 1,322,000 inhabitants, or very nearly two-thirds of the population of the State.

The value of these reports is annually increasing, and they serve an important end in comparing the mortality of municipalities with each other, such statistics having a decided value as an index of actual sanitary conditions.

Such statistics are too often misconstrued, and erroneous deductions are often drawn from them, especially when applied to small numbers of people and to brief periods of time.

The preventable causes of death are those which chiefly concern the sanitarian, and it is with these that the weekly mortality reports of the Board are mainly concerned. While the system of registration employed in the State of Massachusetts has been brought to a higher state of perfection than that of any other State in the Union, it is by no means perfect, a lack of promptness and of accuracy being the chief elements which diminish the value of the returns. The former, want of promptness, is a characteristic of many of the small towns, in which the registration laws are not carefully enforced, the custom of requiring a return of deaths only at the close of each year still prevailing in many of the country districts. The second fault, *inaccuracy*, is more common, both in cities and towns, and is due to the existence of a law which recognizes every one as a physician who styles himself as such, whether competent or not to judge of the causes of death. This source of inaccuracy has been fully illustrated in earlier reports upon vital statistics.

The present report, like that of 1884, differs from the Registration Report of the State in the following essential points: —

1. It is a partial report, i. e., a report for two-thirds of the population.
2. It does not correspond exactly with the calendar year, being made up from weekly rather than from monthly returns.
3. The death-rate must differ slightly from that of the whole population, since the present report comprises a greater proportion of the city than of the rural population.

The following sample of the postal card employed in the collection of returns of deaths shows the sources and mode of making up the returns at the office of the Health Department: —

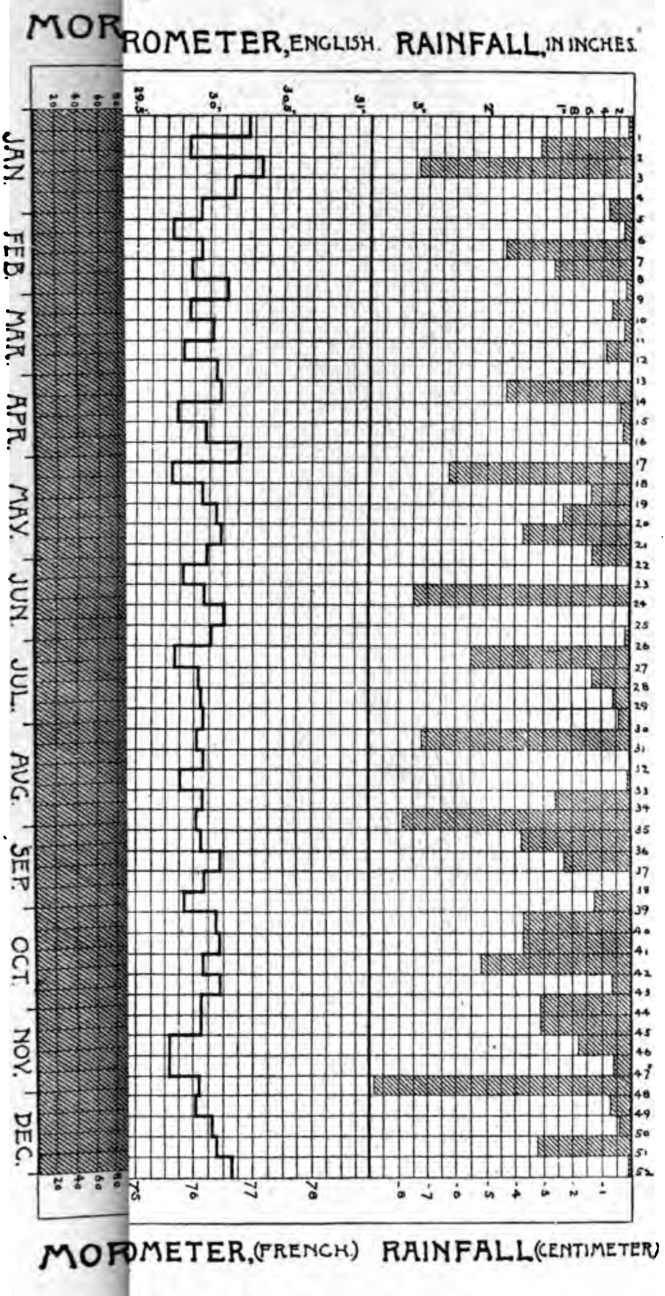
REPORT OF DEATHS in ______________________ for the Week ending Saturday NOON, ______________________ 188 .

[Please note any mortality from UNUSUAL causes not specified in this Blank, and the PREVALENCE, TO A GREAT EXTENT, OF ANY DISEASE.]

[Under the head of CASES OF SMALL-POX, please put the number before the word CASES, and not after it.]

DISEASES.	DEATHS.
Small-pox, ...	
________ CASES OF SMALL-POX, . . .	
Measles, ...	
Scarlet Fever or Scarlatina, ...	
Cerebro-spinal Meningitis, ...	
Diphtheria and Croup, ...	
Whooping Cough, ...	
Erysipelas, ...	
Typhoid Fever, ...	
Puerperal Fever, ...	
________ Fever, ...	
________ Fever, ...	
Diarrhœal Diseases, ...	
Consumption or Phthisis, ...	
Acute Lung Diseases, ...	
DEATHS UNDER 5, ...	
Deaths from ALL CAUSES, not including Still-births, ...	
Still-births, ...	

REMARKS.



ldren under 5 years of age,
eekly rain fall at Boston.

For the greater part of the year the calculation of death-rates was made from estimates of population, based upon the National Census of 1880. The rate of increase since 1870, together with the increase in assessed polls, being employed as factors in the calculation. For the latter part of the year, the State Census of 1885 was employed.

Of the 24,524 reported deaths, the percentages of mortality in the different quarters of the year were as follows : —

	First Quarter. Per Cent.	Second Quarter. Per Cent.	Third Quarter. Per Cent.	Fourth Quarter. Per Cent.
Total deaths, . . .	26.40	25.53	27.68	20.38
Deaths under 5, . .	23.76	21.94	36.62	17.67

An examination of the following statistics shows that, so far as the reporting population is concerned, the year 1885 was a year of unusual health in Massachusetts. The death-rate of this population for the year (1,322,000 people) was 18.55 per thousand.

The data embraced in this report are as follows : —

Average height of barometer for each week.
Mean of daily maximum temperature.
Mean of daily minimum temperature.
Rainfall expressed in inches.
Humidity.
Total deaths for each week reported.
Deaths of children under five years.
Deaths from infectious diseases.

- Consumption.
- Acute Lung Diseases.
- Typhoid Fever.
- Diarrhœal Diseases.
- Scarlet Fever.
- Measles.
- Diphtheria and Croup.
- Puerperal Fever.
- Whooping Cough.
- Malarial Fever.
- Small-pox.
- Erysipelas.

General Summary.

DATE.	Barometer.	Maximum Thermometer. Mean for ea. week.	Minimum Thermometer. Mean for ea. week.	Rain. — Inches.	Humidity. Mean for ea. week.	Total Deaths.	Deaths under 5.	Infectious Diseases.	Consumption.	Acute Lung Diseases.	Typhoid Fever.	Diarrhœal Diseases.	Scarlet Fever.	Measles.	Diphtheria and Croup.	Puerperal Fever.	Whooping Cough.	Malarial Fever.	Small-pox.	Erysipelas.	Death-rates per 1000.
1885.																					
January 3,	30.268	36.	27.9	.02	71.6	474	124	100	60	93	10	28	10	2	43	1	4	-	-	-	19.80
" 10,	29.855	49.5	29.6	1.23	66.5	476	130	81	75	84	6	-	13	5	36	3	6	1	-	4	19.62
" 17,	30.359	42.7	23.3	2.94	75.7	489	165	62	75	80	3	6	12	1	29	1	3	1	-	-	18 37
" 24,	30.153	27.1	9.5	-	63.3	494	141	68	68	80	6	8	7	2	25	3	11	-	-	2	18.54
" 31,	29.940	28.2	10.	.31	65.1	417	161	76	51	86	4	1	9	6	39	1	3	-	-	5	15.09
February 7,	29.748	26.4	10.8	.12	66.2	502	163	78	74	92	11	5	15	5	33	5	4	-	-	2	19.15
" 14,	29.940	26 6	9.3	1.77	69.1	522	163	59	86	94	5	3	7	3	20	4	2	-	-	2	20.57
" 21,	29.881	29.4	10 9	1.07	63.3	464	128	58	66	86	6	5	5	5	22	2	2	-	-	5	18.25
" 28,	30.110	32.3	19 4	.04	66.2	537	150	68	69	97	7	-	9	1	34	3	1	-	-	2	20.76
March 7,	29.877	42.8	26.8	.26	66.5	484	124	42	93	99	11	4	6	3	11	-	-	-	-	2	17.75
" 14,	30.029	28.9	12.2	.10	67.7	546	169	71	30	121	8	-	13	4	26	2	3	1	-	3	19.48
" 21,	29.817	30.3	13.	.37	61.5	537	180	63	70	115	-	9	11	4	16	3	2	1	-	3	19.30
" 28,	30.051	40.1	21.	-	58.1	533	162	51	73	123	-	7	10	3	16	2	2	-	-	3	19.09
April 4,	30 083	51.2	31.1	1.73	68.7	546	162	62	70	116	5	-	19	1	21	2	1	1	-	-	20.80
" 11,	29.792	48.2	31.6	.18	65.3	608	184	92	96	119	5	14	12	5	34	3	4	1	-	4	21.77
" 18,	29.980	49.2	31.6	.11	61.	559	169	63	98	124	2	2	14	6	22	5	3	-	-	1	20.15
" 25,	30.206	72.3	47 4	-	56.5	555	148	60	81	112	8	10	7	6	18	2	-	-	-	3	19.73
May 2,	29.740	56.2	39 2	2.48	72.9	481	137	49	73	100	3	3	6	10	19	-	-	-	-	4	19 00
" 9,	29.952	53.2	39.2	.56	75.7	498	138	51	72	103	4	8	7	4	21	2	1	-	-	3	17.93
" 16,	30.041	61.1	43.7	.93	63.2	454	133	60	73	81	3	-	14	5	21	-	1	1	1	3	17.52
" 23,	30.091	64.7	48.4	1.46	75.4	501	151	61	71	76	6	12	12	9	12	3	2	-	-	2	18.19
" 30,	29.998	71 3	53.3	.52	66 7	417	111	47	57	84	3	6	8	6	13	2	3	-	-	-	15.43
June 6,	29.816	65.4	48.7	-	77.3	428	117	42	85	40	1	5	8	3	19	1	2	-	-	1	16.54
" 13,	29.972	77.	54.5	3.	55.1	400	106	60	68	38	3	7	7	11	24	-	-	-	-	1	14.59
" 20,	30.109	84.	59.2	-	54.8	448	141	66	68	38	5	16	11	4	14	3	2	1	-	4	16.56
" 27,	30.015	80.2	59.3	.02	57.3	367	114	64	54	30	4	17	10	3	18	-	-	-	-	3	15.00
July 4,	29.785	74.1	56.6	2.20	74.2	376	122	55	56	31	3	24	6	1	12	2	1	1	-	-	13 48
" 11,	29.922	82.	65.2	.51	73.	456	181	101	56	26	5	65	11	-	14	-	-	-	-	-	17.33
" 18,	29.941	80.1	62 8	.23	64.9	528	235	157	65	26	4	118	7	1	17	-	2	-	-	1	23.81
" 25,	29.966	84.9	67.3	.18	68.8	675	378	258	64	20	9	228	2	1	13	2	-	-	-	-	23.83

August 1,	29.918	77.1	63.1	2.87	75.6	712	384	288	67	30	6	248	4	-	16	2	1	1	-	2	25.98
" 8,	29.972	74.	62.5	-	78.1	591	322	227	58	12	7	196	5	2	8	-	5	-	-	-	23.27
" 15,	29.804	80.9	65.7	.01	77.9	610	292	187	71	24	10	161	-	-	8	1	2	1	-	-	23.70
" 22,	29.969	78.1	60.6	1 03	67.7	529	238	174	74	15	12	142	7	1	8	3	1	-	-	1	19.47
" 29,	29.916	70.5	54.4	3.16	72.	501	209	130	83	20	7	107	4	1	10	1	-	-	-	-	18.27
September 5,	29.942	70 4	54.5	1.54	73.6	462	176	111	70	16	7	78	14	1	8	1	-	1	3	-	17.19
" 12,	30.078	66.9	48.	.91	73.6	461	171	118	73	30	22	75	3	-	9	-	5	-	1	1	18.16
" 19,	29.978	76.3	56 6	-	67.7	471	167	95	58	30	18	50	4	-	13	1	-	1	1	-	17.76
" 26,	29.829	64 5	45.7	.51	70.5	417	146	80	80	25	13	35	9	2	17	-	-	-	-	1	15.05
October 3,	30.055	63 9	52.1	1.50	84	384	108	74	68	70	19	27	2	2	19	-	1	-	2	-	14 06
" 10,	30.073	57.4	40.9	1.50	67.8	401	123	70	73	60	17	16	11	2	18	1	2	-	-	1	1[illegible].57
" 17,	29.963	59.4	44.8	2.08	75.	421	147	65	64	18	11	25	5	2	22	1	2	-	-	-	15 61
" 24,	30.093	63.1	47.3	.24	79.9	363	100	57	58	37	16	17	2	-	20	1	-	-	1	-	14.38
" 31,	29.946	55.	40.9	1.25	83.4	356	123	64	60	25	10	17	6	1	24	1	1	-	2	1	15.68
November 7,	29.947	55.8	40.7	1.23	79.9	418	129	65	67	37	8	10	9	1	31	1	1	-	-	1	16.26
" 14,	29.742	68.8	37.4	.72	71.6	372	87	45	70	39	9	7	8	-	18	-	-	-	-	1	14.57
" 21,	29.733	48.1	34.4	.23	65.6	371	104	61	66	28	9	14	4	2	34	-	-	-	-	2	14.94
" 28,	29.940	41.1	31.3	3.55	84 3	435	92	49	66	30	6	10	3	1	28	-	-	-	-	-	18.48
December 5,	29.928	44.9	29.1	.33	71.8	343	106	41	63	34	5	5	4	1	22	-	-	-	-	-	14 33
" 12,	30.026	45.3	22.9	.19	66.9	394	120	43	56	40	7	4	9	-	19	-	1	-	-	-	16.26
" 19,	30 066	40.8	27.4	1.33	74.2	379	115	42	67	46	6	3	8	-	17	-	-	-	-	2	15.29
" 26,	30.166	38.1	20.	.01	60 9	361	104	59	66	52	15	9	8	-	23	-	2	-	-	-	15 63
Total,	-	-	-	-	-	24,524	8,250	4,370	3,575	3,063	390	1,861	417	139	1,054	71	89	13	11	76	-
Weekly average,	-	-	-	-	-	471	159	84	69	59	7	36	8	2.7	20.3	1.35	1.71	.25	.21	1.46	18.02
Ratio per 1,000 deaths,	-	-	-	-	-	-	-	179.2	144.9	124.9	15.9	76 5	16.2	5.63	42.9	2 93	3.63	.6	.45	.3	-
Ratio per 1,000 population,	-	-	-	-	-	-	-	3 30	2 61	2.31	.295	1.41	.31	.11	.797	.054	.068	.011	.008	.057	.143

[From October 10th, the population is taken from the State Census of 1885.]

Total Deaths.

The whole number of deaths reported from cities and towns included in this report was 24,524, and the average number per week was 471.

The greatest number of deaths reported in any week was 712, for the week ending August 1. The least number, 343, in the week ending December 5.

The weekly average number of deaths reported for each month was as follows: —

January,	470	July,	509
February,	506	August,	589
March,	525	September,	453
April,	567	October,	385
May,	470	November,	399
June,	411	December,	369

The months in which the greatest number of deaths was reported were August and April, and those in which the least number was reported were December and October.

Deaths under Five Years.

The whole number reported was 8,250, the weekly average for the year being 159.

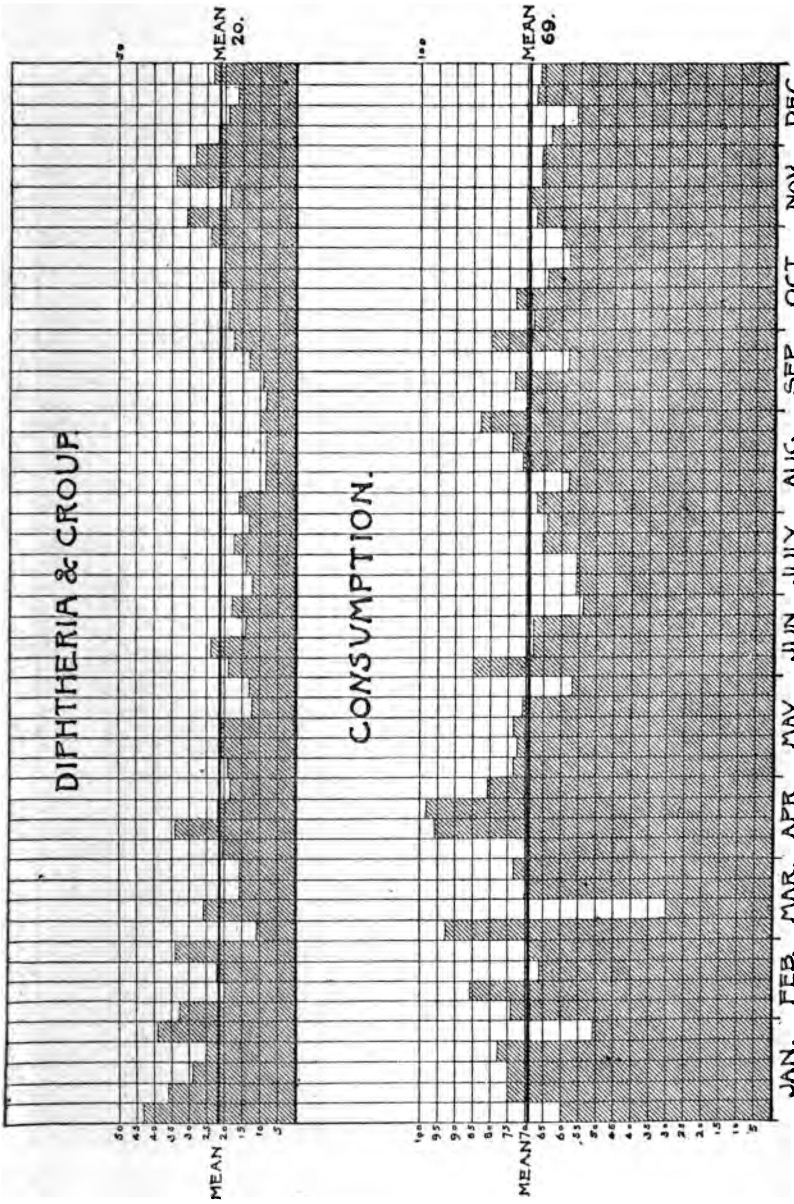
The least number reported in any week was 87, in the week ending November 14; and the greatest number, 384, in the week ending August 1.

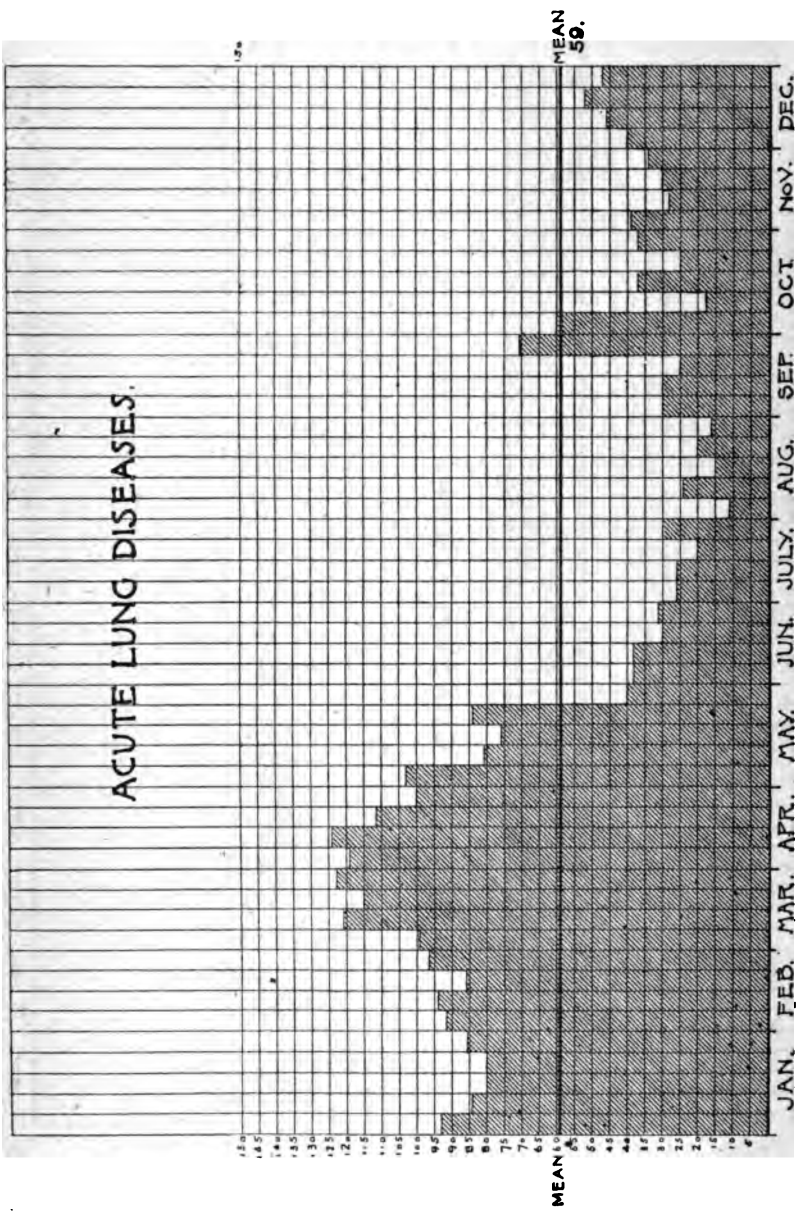
The ratio of deaths under five to the total number of deaths was 33.7, or one in 2.97; less than that of 1884, and also less than that of the State for ten years, — 1871–80.

The average weekly number of reported deaths of children under five years, for each month, was as follows: —

January,	144	July,	229
February,	151	August,	289
March,	159	September,	165
April,	166	October,	120
May,	134	November,	103
June,	119	December,	111

Months having the least number of deaths, November and December; months having the greatest number, July and August.


DIPHTHERIA & CROUP.
CONSUMPTION.
MEAN 20.
MEAN 69.
MEAN
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JULY.
AUG.
SEP.
OCT.
NOV.
DEC.


ACUTE LUNG DISEASES.
MEAN 59.
JAN. FEB. MAR. APR. MAY. JUN. JULY. AUG. SEP. OCT. NOV. DEC.
MEAN

Consumption.

The reported number of deaths from consumption was 3,555. The reported weekly average for the year was 68.

The average weekly number of deaths reported for each month was as follows: —

January,	82	July,	60
February,	74	August,	71
March,	69	September,	68
April,	86	October,	65
May,	69	November,	65
June,	69	December,	62

The months having the least number of deaths were July, October and November. Months having the greatest number were January and April.

The ratio per thousand of reported deaths from all causes was 144.9; the ratio for the previous year being 154.04. The death-rate per thousand of the population from this, the most destructive of all diseases incident to our New England people, was 2.69. These figures are remarkable as being considerably less than those reported for any previous year. The rate for 1884 was 2.78.

Acute Lung Diseases: Pneumonia, Bronchitis, Asthma, Pleurisy.

The number of deaths reported from acute lung diseases was 3,063. The weekly average was 59.

The average weekly number of deaths reported for each month was as follows: —

January,	85	July,	26
February,	92	August,	20
March,	114	September,	25
April,	118	October,	42
May,	89	November,	33
June,	36	December,	43

The months having the least number of reported deaths were July, August and September. Those having the greatest number were March and April.

The ratio per thousand deaths from acute lung diseases was 124.9. For the previous year it was, as reported, 105.7.

The ratio per thousand of the reporting population was 2.31. The mortality from these diseases was considerably greater than that of the two previous years.

Typhoid Fever.

The number of reported deaths from typhoid fever was 390. The weekly average was 7.

The average number in each month was as follows: —

January,	6	July,	5
February,	7	August,	8
March,	5	September,	15
April,	5	October,	15
May,	4	November,	8
June,	3	December,	8

The months having the least number of deaths were May and June. Those having the greatest number were September and October.

More than two-thirds of the reported deaths from this disease occurred in the last half of the year.

The ratio per thousand deaths from all causes reported was 15.9, which was much less than that of any previous year.

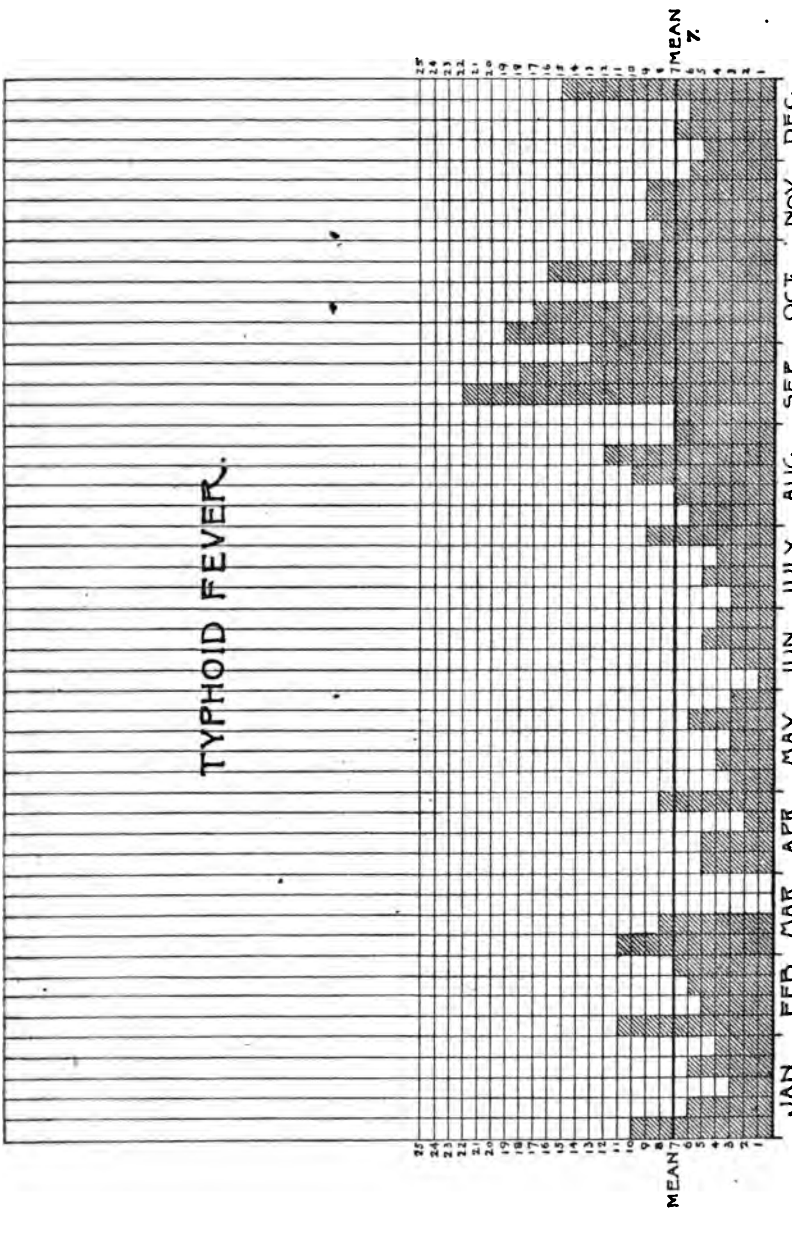
This favorable result is doubtless largely due to the preponderance of cities (having pure water supplies) which contribute to this report.

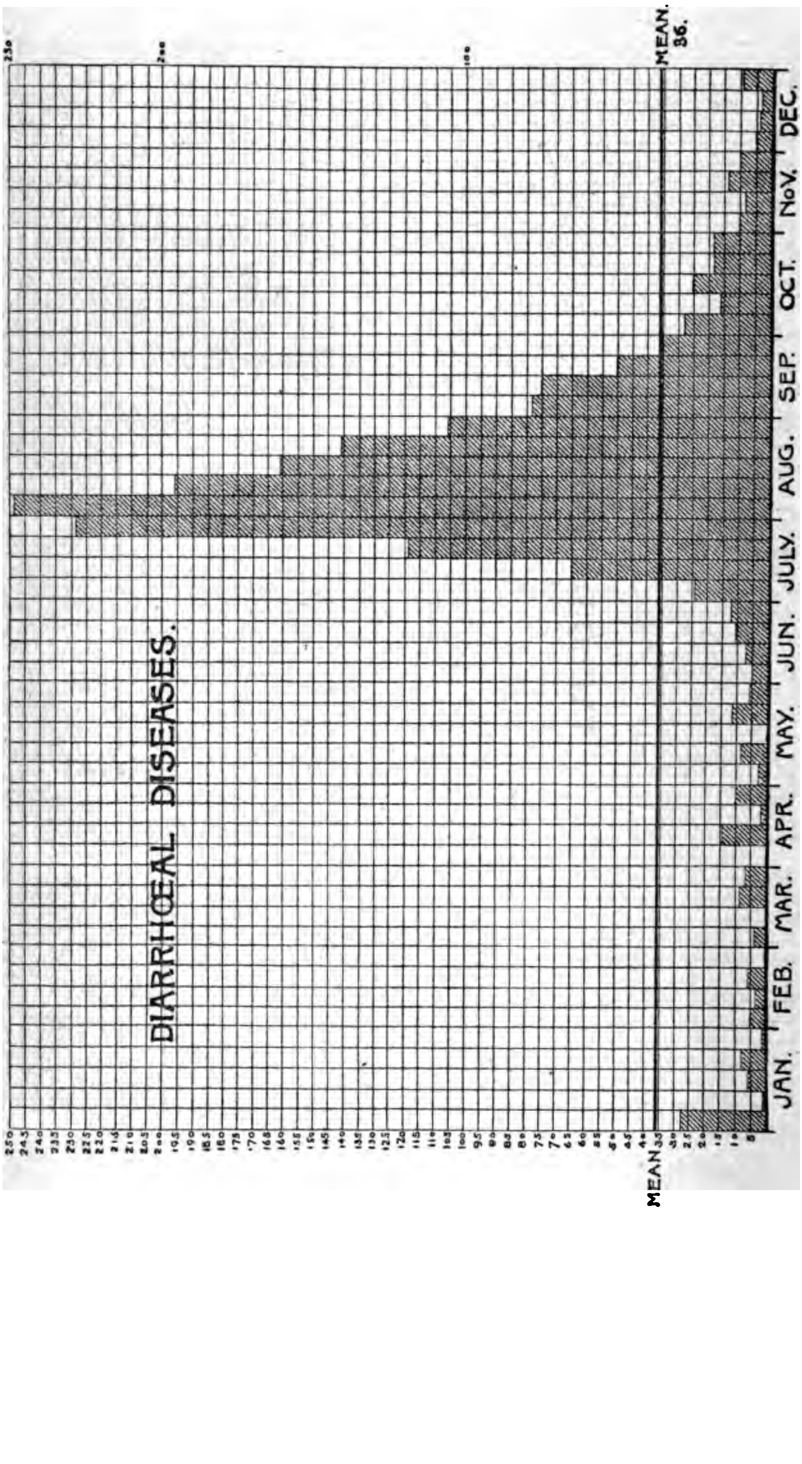
For the decade 1861–70, the average annual mortality was 46.9 per thousand deaths from all causes, and for the decade 1871–80 it was 31.7. For the former decade treble, and for the latter double that of 1885.

The mortality per thousand of the living population as reported was .295. That of the previous year being .405.

Diarrhœal Diseases, including Diarrhœa, Dysentery, Cholera Infantum, Cholera and Enteritis.

The number of deaths reported from diarrhœal diseases was 1,867, and the weekly average 35.


TYPHOID FEVER.
JAN. FEB. MAR. APR. MAY. JUN. JULY. AUG. SEP. OCT. NOV. DEC.
MEAN 7


DIARRHŒAL DISEASES.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JULY.
AUG.
SEP.
OCT.
NOV.
DEC.
MEAN. 36.
MEAN

The average weekly mortality from these diseases in each month was as follows: —

January,	9	July,	109
February,	3	August,	170
March,	5	September,	48
April,	7	October,	20
May,	6	November,	10
June,	11	December,	5

The months having the least number of deaths from this group of diseases were February, March and December. Those having the greatest number were July and August.

The mortality in the last six months of the year was 89.5 per cent. of the whole number for the year, and for the three months of July, August and September it was 81.5 per cent.

The ratio of reported deaths from these diseases to the whole number reported was 76.1 per thousand. In 1883 it was 91.8. In 1884 it was 89.4.

The reported ratio for the United States for the census year 1880 was 86.6.

The mortality per thousand of the living population, as reported, was 1.41. For 1884 it was 1.62.

Scarlet Fever.

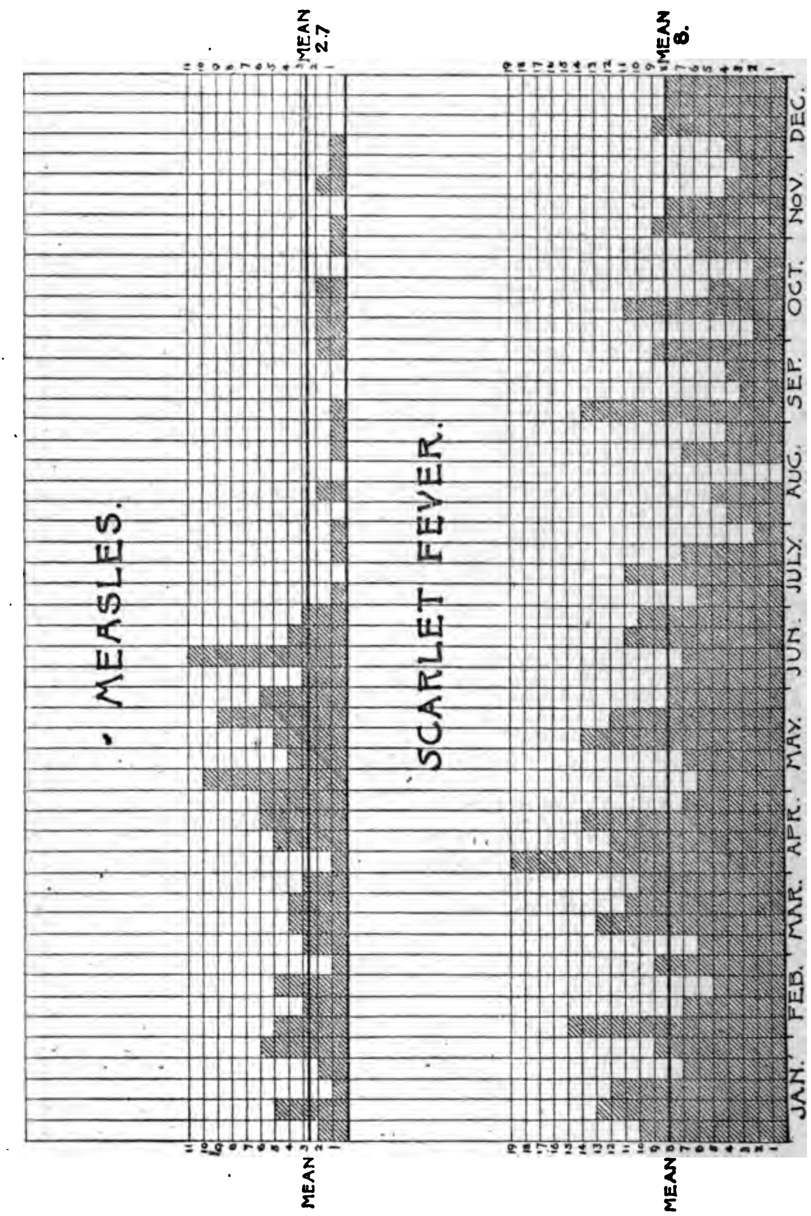
The total number of reported deaths from scarlet fever was 407, and the weekly average 8.

The average weekly mortality of reported cases in each month was as follows: —

January,	10	July,	6
February,	9	August,	4
March,	10	September,	7
April,	13	October,	5
May,	9	November,	6
June,	9	December,	7

The months having the least number of deaths were July, October and November. Those having the greatest number were January, March and April.

The ratio of reported deaths from this disease to reported deaths from all causes was 16.5 per 1,000, being less


MEASLES.
SCARLET FEVER.
MEAN 2.7
MEAN 8.
MEAN
MEAN
JAN. FEB. MAR. APR. MAY. JUN. JULY. AUG. SEP. OCT. NOV. DEC.

than that of the previous year (17.7), and but little in excess of that of 1883 (16.2). It was also very much less than the average for the twenty years 1861–1880. (Massachusetts Registration Reports.)

The mortality per 1,000 of the living population from this cause was .31.

Measles.

The whole number of deaths reported from measles was 139. The weekly average was less than 3.

The average weekly mortality was distributed as follows: —

January,	3	July,	1
February,	3	August,	1
March,	3	September,	1
April,	4	October,	1
May,	7	November,	1
June,	5	December,	0

The months having the least number of deaths from measles were July, September and December. Those having the greatest number were May and June. There were but 22 reported deaths from measles in the last half of the year.

The ratio of deaths reported to deaths from all causes was 5.67 per 1,000, which was considerably in excess of that of the previous year, 1.8. It was also less than the average for the twenty years 1861–1880, which was 7.38 per thousand.

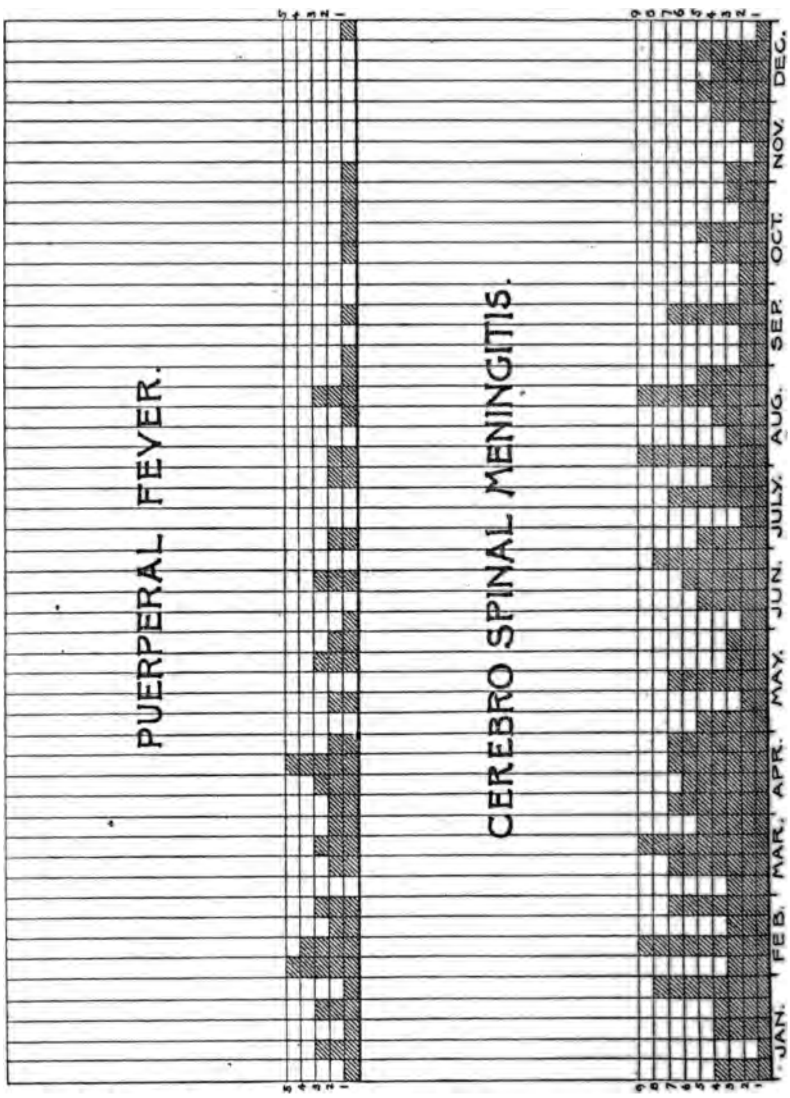
The ratio of deaths per 1,000 of the living population was .105.

Diphtheria and Croup.

The total number of deaths reported from these diseases was 1,054. The weekly average was 19.9.

The average weekly mortality, as reported, was distributed as follows: —

January,	34	July,	14
February,	27	August,	10
March,	17	September,	12
April,	24	October,	21
May,	17	November,	25
June,	19	December,	22


PUERPERAL FEVER.
CEREBRO SPINAL MENINGITIS.
JAN. FEB. MAR. APR. MAY. JUN. JULY. AUG. SEP. OCT. NOV. DEC.
1 2 3 4 5
1 2 3 4 5 6 7 8 9

The months having the least number of reported deaths were August and September. Those having the greatest number were January and February.

The ratio of deaths reported from these causes to all reported deaths was 43. It was less than that of the previous year, which was 45.3.* It was also considerably less than the average of the ten years 1871–80.

The death-rate per 1,000 of the living population from these diseases was .80.

Puerperal Fever.

The total number of deaths reported from puerperal fever was 72. The weekly average was 1.4.

The average weekly mortality for each month was as follows: —

January,	1.8	July,	1.
February,	3.5	August,	1.4
March,	1.7	September,	.5
April,	3.	October,	.8
May,	1.4	November,	.2
June,	1.	December,	.0

The months having the least mortality from this disease were November and December. Those having the greatest mortality were February and April. As in the preceding year, the mortality of the first half of the year from this cause was much in excess of that of the last half, 74 per cent. of the deaths having occurred in the first six months of the year.

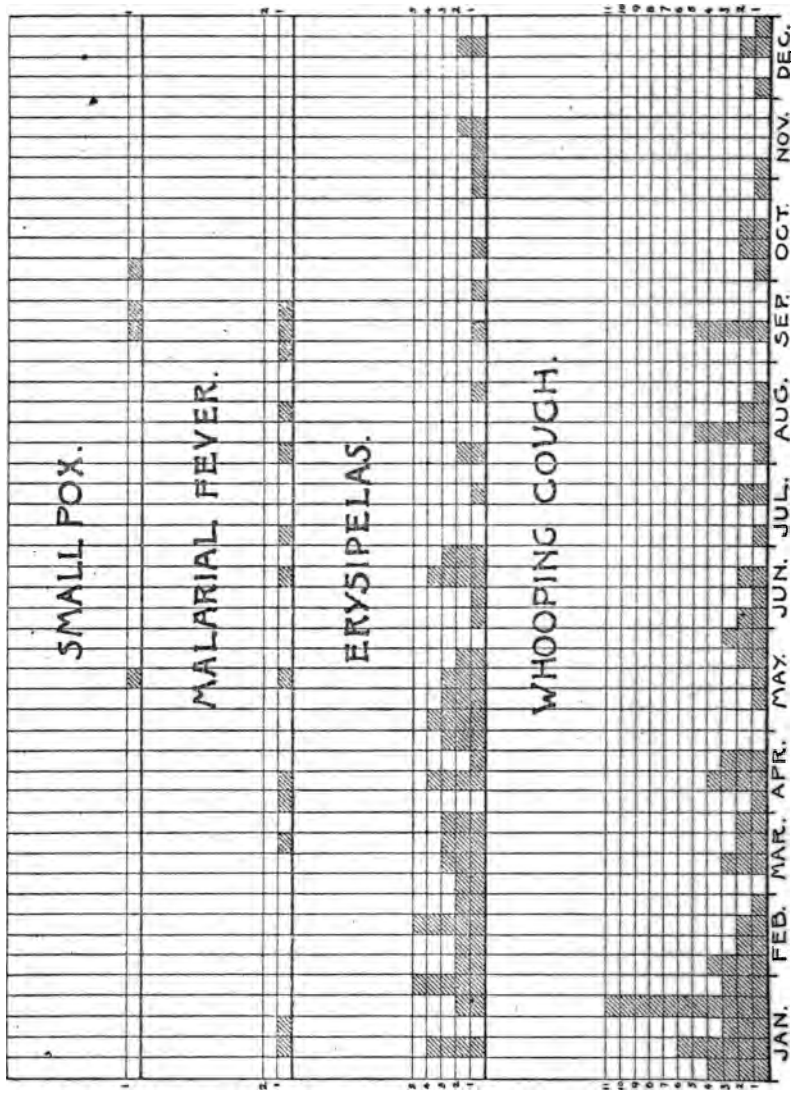
The ratio per 1,000 deaths from all causes was 2.9. For the preceding year it was 4 2.

The mortality per 1,000 of the living population was .054.

If puerperal fever is not properly a filth disease in the sense employed by the foremost of British hygienists, the weight of evidence is at present clearly in the direction of pronouncing it at least a *preventable* disease.

The importance of observing the strictest rules of cleanliness in the care of lying-in women, by the physician, the nurse, and by attendants of any sort, is acknowledged.

* Incorrectly reported in the report of 1884 as 40.5.


SMALL POX.
MALARIAL FEVER.
ERYSIPELAS.
WHOOPING COUGH.
JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC.

The question sometimes asked, "How soon after exposure to infection may the accoucheur resume practice?" has been recently answered by Esmarch, as follows: "If you have thoroughly disinfected yourself, you can immediately enter upon obstetric practice. Time does not destroy septic dirt."

The subject of disinfection, however, should be well understood by the obstetrician, and no reliance placed upon inefficient agents. Doubtless many lives may be saved if every obstetrician will make the subject of disinfection a matter of careful study, with reference to its employment in lying-in practice, in its application to himself, to the nurse, to the patient, and also to appliances used in such practice. The majority of cases concern the lives of two human beings, the mother and her child; and, on the one hand, while it is doubtless true that lives have been sacrificed by a neglect of careful disinfection, other lives have also as clearly been sacrificed to its abuse.

Whooping Cough, Erysipelas, Malarial Fever, Small-pox.

The reported deaths from these diseases have been as follows: —

	Total deaths reported.	Weekly average.
Whooping-cough,	90	1.7
Erysipelas,	76	1.4
Malarial fevers,	13	.25
Small-pox,	11	.2

The mortality per 1,000 deaths from all causes, as reported, was as follows: —

Whooping-cough,	3.6
Erysipelas,	3.
Malarial fevers,	.53
Small-pox,	.45

The mortality per 1,000 of the living population, as reported, was as follows: —

Whooping-cough,	.068
Erysipelas,	.057
Malarial fevers,	.01
Small-pox,	.008

Whooping Cough.

The mortality from this disease was much less than that of the preceding year, and nearly the same as that of 1883. While the deaths from whooping-cough are almost exclusively among children under five years of age, who are therefore not in the public schools, it is nevertheless important that all children suffering with whooping-cough should be excluded from the schools until they have recovered, since it is often communicated by them to other children in such schools, who, in turn, transmit the disease to smaller children at home, to whom it not unfrequently proves fatal.

Malarial Fevers.

The total number of deaths reported from malarial fevers for 1885 was thirteen. These cases occurred in the following places: —

In the nine eastern counties there were nine deaths, as follows: In Lowell, 3; in Fall River, 4; in Plymouth and Salem, one each.

In the five western counties: Springfield, 4 deaths.

A full account of the outbreak at Framingham, alluded to last year,* will be found in this report. This outbreak was severe, and affected a large portion of the population of that town. It was not, however, destructive to life, and does not therefore materially affect this portion of the report.

Small-pox.

The number of deaths from small-pox reported for 1885 was 11, a slight increase over the number reported for the previous years, 1883 and 1884, but still very much below the annual average of the previous thirty-one years, which was 152. The severe epidemic of 1872–73, and also of other previous years, materially affected this average. The average for the eleven years, 1874–84, was less than 24.

Greater pains were taken during the past year to ascertain the source of each case, so far as was possible, and also other material facts in relation to the same; especially such

* Sixth Supplement, p. 236.

as related to the existence or non-existence of previous vaccination. While such observation is carefully made in many foreign cities and countries, it is almost entirely neglected in the United States. It is desirable that all local boards of health should require such observation to be made and carefully recorded in every case of small-pox, whether the case proves fatal or not.

During the past year thirty-two cases of small-pox were reported to the board, including the eleven fatal cases already mentioned. These occurred in twelve cities and towns.

Contrary to the experience of former epidemics, no cases occurred in towns where large paper manufactories, employing rags, were located.

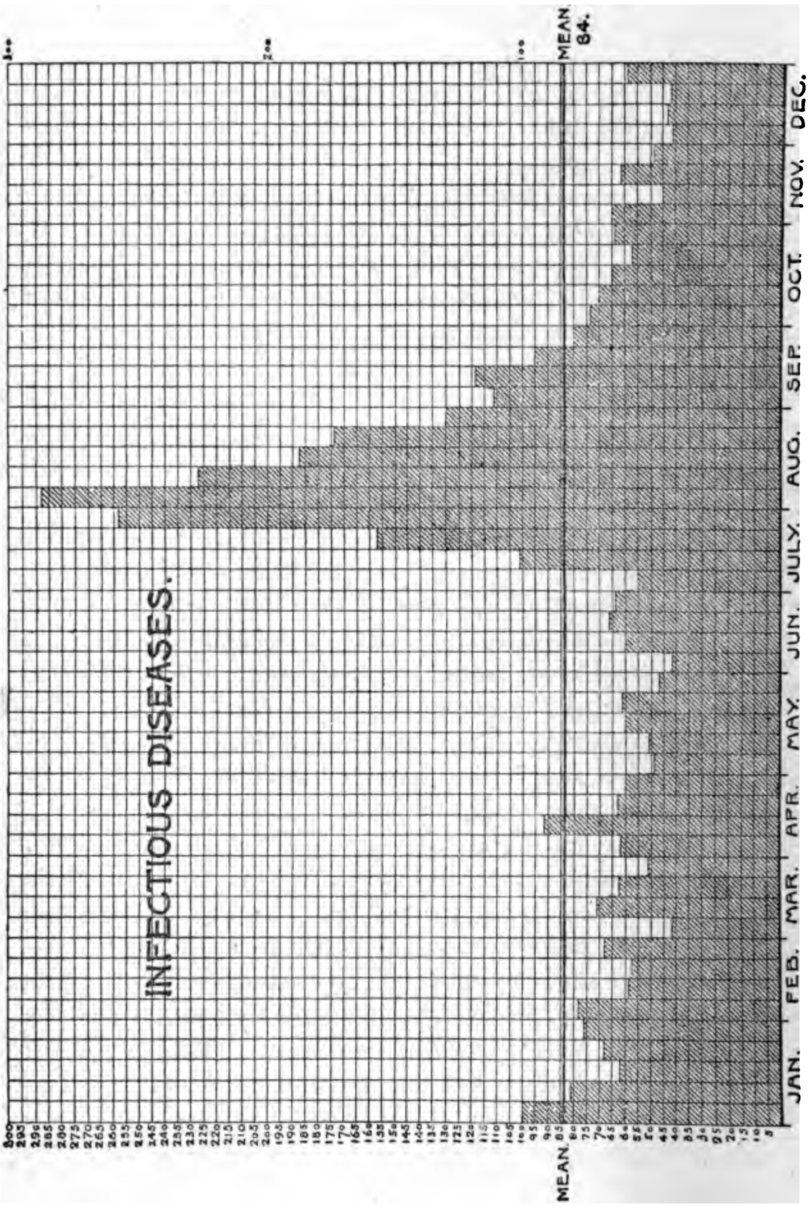
The majority of the cases occurred between September 1 and November 15, the period when the epidemic at Montreal was at its height, and were traced either directly or indirectly to communication with that city or its neighboring infected districts. The persons who were known to have brought the disease to Massachusetts, and in some instances to have communicated it to other members of their own families, being mainly unvaccinated French Canadian immigrants.

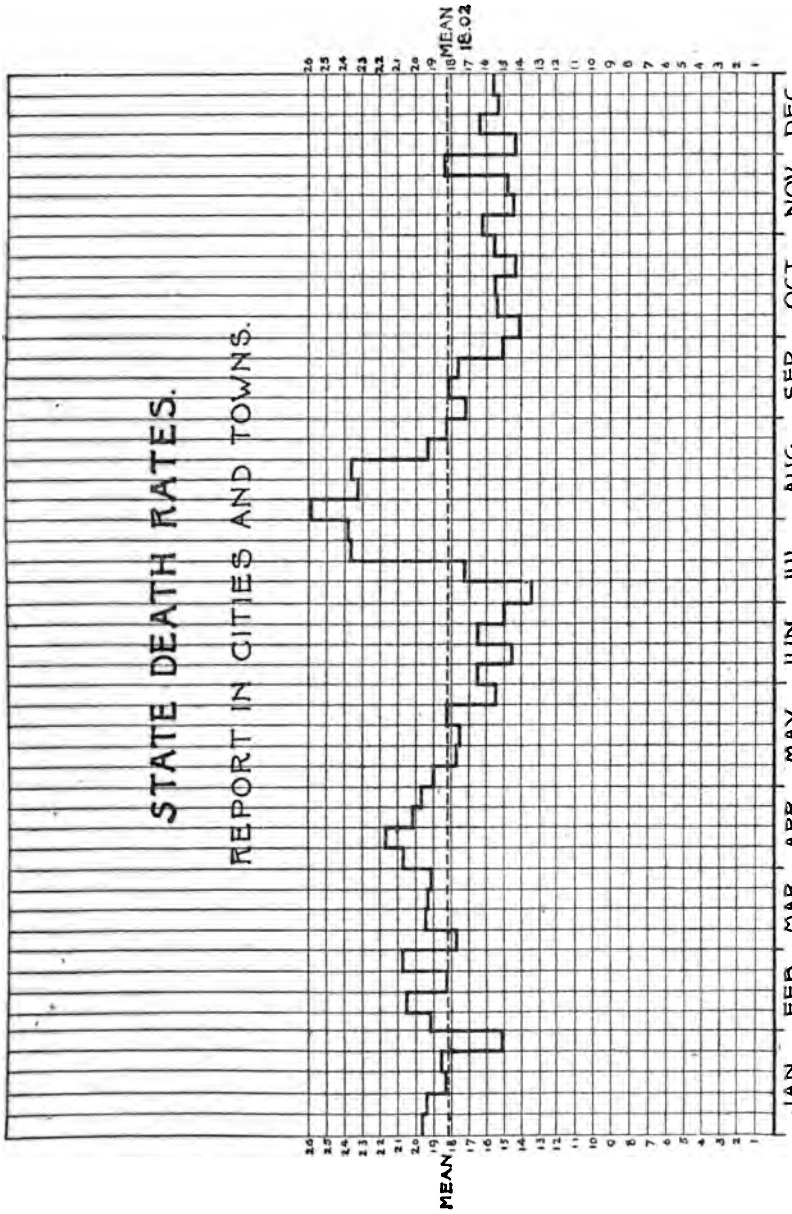
There could be no more convincing argument for the protective power of vaccination than the recent experience of Montreal, in which 3,164 persons perished from small-pox, of which number 2,888 were French Canadians, among whom neglect of vaccination is proverbial.

In consequence of the vigilance of local authorities, and also of immediate measures taken by the State Board in small towns, the disease did not gain a foothold beyond the first cases which occurred. The measures taken for the protection of the State by means of quarantine upon the Canadian border, enforced by the general government through the action of the Marine Hospital service, are detailed in the Seventh Annual Report of the Board. (P. lviii.)

In this connection the following remarks from a recent article upon the subject of small-pox are pertinent to this phase of the question: —

There is special need of vigilance on the part of all local Boards of Health, whom the statutes have charged with the duty of protecting the public. Adequate power is given them for enforcing the statutes, and


INFECTIOUS DISEASES.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JULY.
AUG.
SEP.
OCT.
NOV.
DEC.
MEAN 84.
MEAN.


STATE DEATH RATES.
REPORT IN CITIES AND TOWNS.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
MEAN
MEAN 18.02

such power should be exercised. There can be no doubt that small-pox can be totally excluded from any community, or at least confined to the first cases, by proper sanitary precaution. The following cardinal points should be kept in view by all local authorities having charge of the public health:

(1.) As far as possible guard against the introduction of the disease.
(2.) Vaccination and re-vaccination.
(3.) Isolation and non-intercourse with the sick.
(4.) Disinfection.

Dependence should never be placed on the latter (disinfection) to the exclusion of vaccination, since there is not the slightest evidence that small-pox is in the strict sense a filth disease. No amount of filth will originate small-pox, and although, *ceteris paribus*, habits of cleanliness will in a measure prevent contagion, a community of unvaccinated people who are scrupulously clean, would undoubtedly fare very much worse in the face of an epidemic of small-pox, than a thoroughly vaccinated community of notoriously filthy habits.

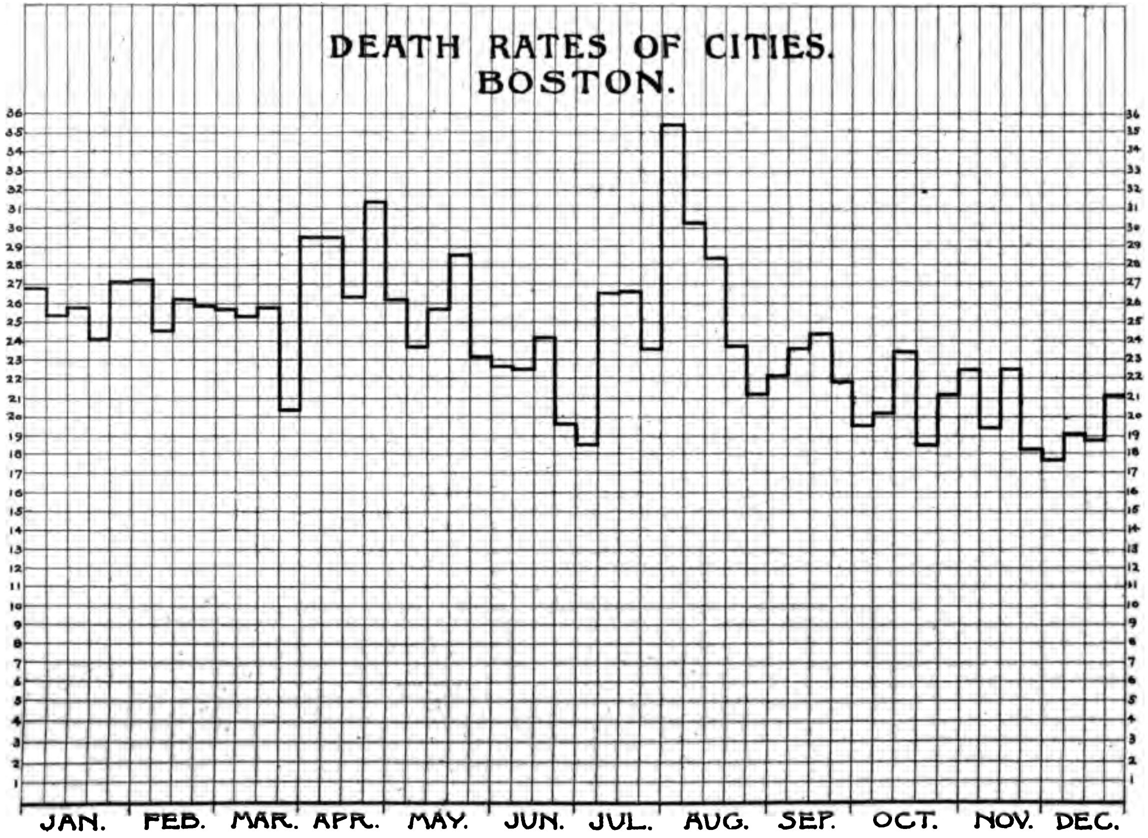
It should be distinctly borne in mind that every unvaccinated person in a community is a source of danger, whose presence should not be tolerated. The public health is paramount to private interests, and no one has the right to endanger the lives of his fellows by means of his own neglect.*

Observations made as to vaccination and non-vaccination of persons attacked with small-pox: —

Whole number of cases which occurred in Massachusetts in 1885,	32
Number in which observations as to vaccination were made,	20
Number of fatal cases,	11
Number of fatal cases in which observation was made as to vaccination,	9
Number of fatal cases which had not been vaccinated,	9
Number of fatal cases in which no observation was made,	2
Number of cases who were known to have been vaccinated, all of whom survived,	7

In addition to the foregoing observations, further inquiry should be made as to the number and size of cicatrices, and also as to re-vaccination.

* Boston Medical and Surgical Journal, Sept. 10, 1885, p. 261.


DEATH RATES OF CITIES.
BOSTON.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.

Mortality-rates of Cities.

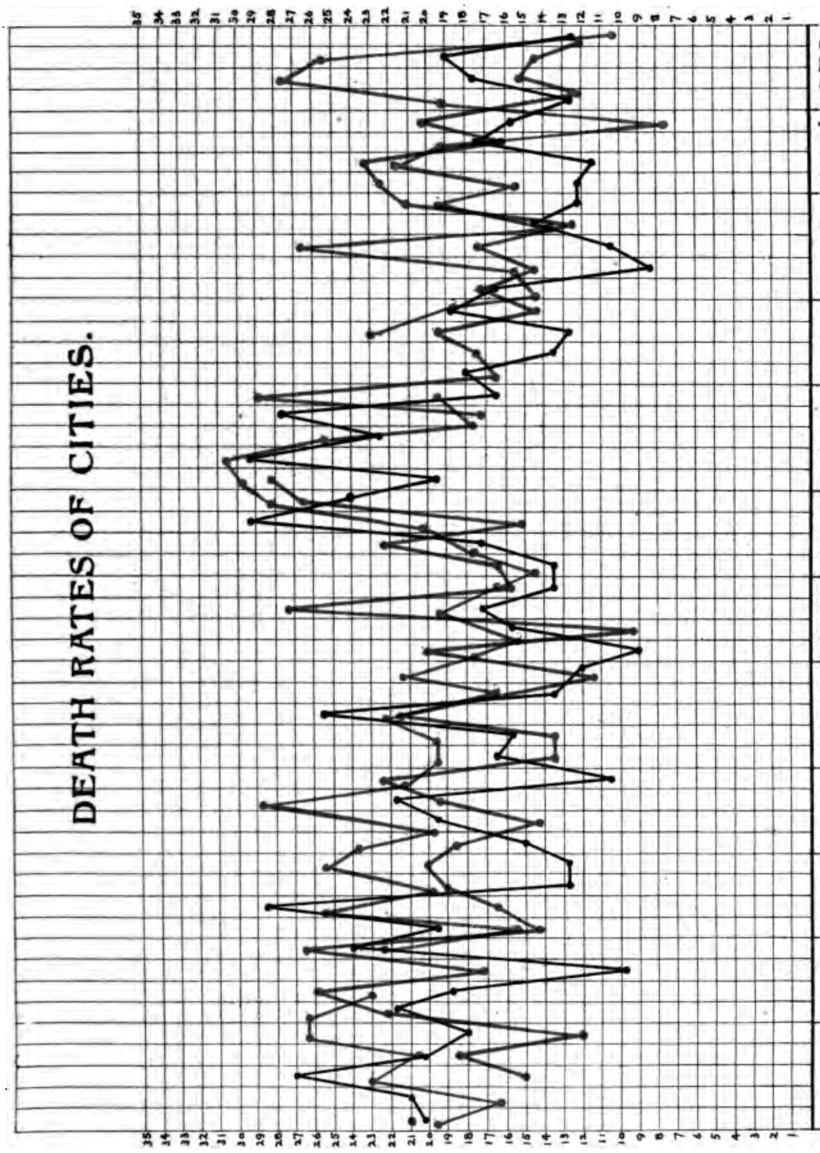
	Boston.		Boston.
Jan. 3,	26 76	July 4,	18.50
10,	25.32	11,	26.50
17,	25.85	18,	26.63
24,	24.01	25,	23.59
31,	27.03	Aug. 1,	35.42
Feb. 7,	27.16	8,	30.18
14,	24.53	15,	28.35
21,	26.24	22,	23.88
28,	25.97	29,	21.25
March 7,	25.72	Sept. 5,	22.04
14,	25.32	12,	23.62
21,	25.72	19,	24.40
28,	20.38	26,	21.91
April 4,	29.52	Oct. 3,	19.68
11,	29.52	10,	20.24
18,	26 37	17,	23.44
25,	31.44	24,	18.65
May 2,	26.11	31,	21 24
9,	23.88	Nov. 7,	22.51
16,	25.72	14,	19.45
23,	28.60	21,	22.51
30,	23.09	28,	18.25
June 6,	22.69	Dec. 5,	17.72
13,	22.57	12,	19.05
20,	24.30	19,	18.78
27,	19.81	26,	21.18

Population of Boston, State Census of 1885, ... 390,406
Death-rate, 1885, ... 24.09
" 1884, ... 25.07

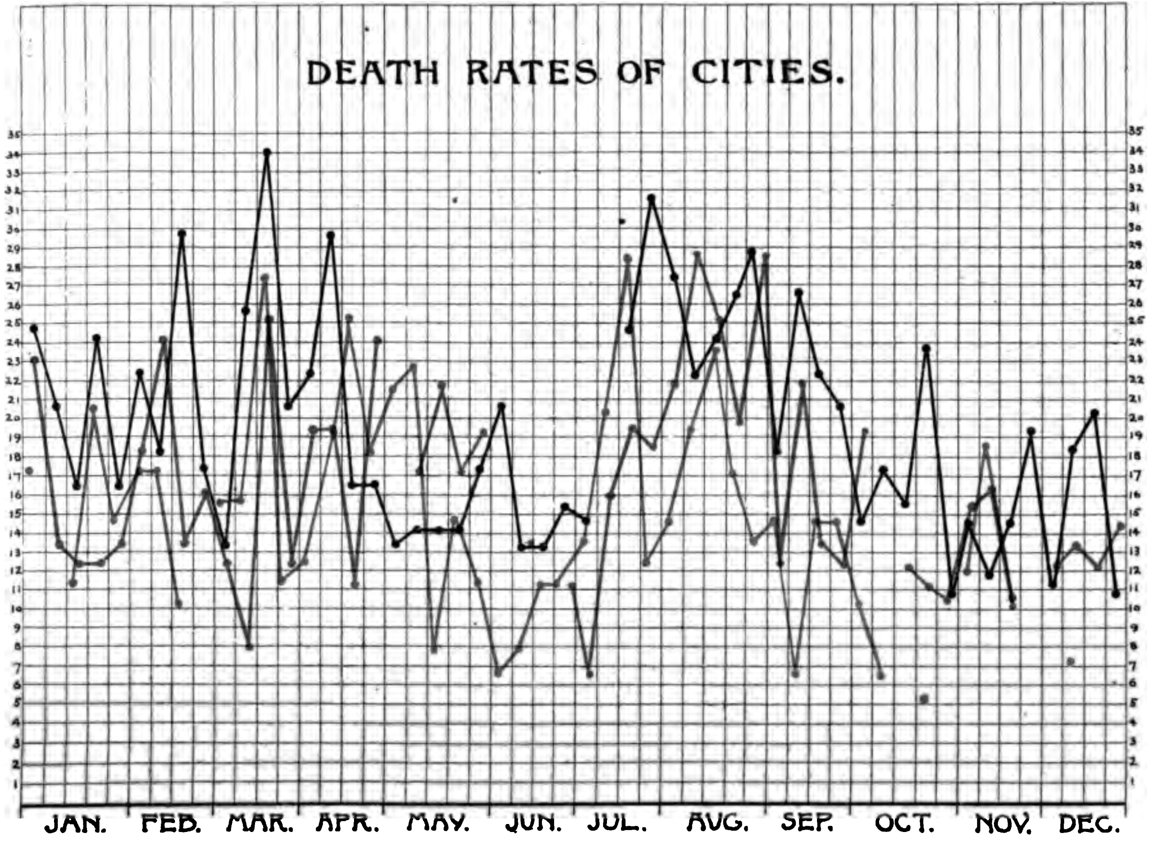
Mortality-rates of Cities.

	Worcester.	Lowell.	Cambridge.		Worcester.	Lowell.	Cambridge.
Jan. 3, . .	20.25	21.10	19.60	July 4, . .	13.50	16.73	14.48
10, . .	21.00	-	16 19	11, . .	17.25	22.56	17.89
17, . .	27.00	15.23	23.00	18, . .	29.25	15 28	20.04
24, . .	20.25	18.92	20.45	25, . .	24.00	26.92	28.12
31, . .	18.00	12.37	26.41	Aug. 1, . .	19.50	28.38	29.82
Feb. 7, . .	21.75	22.56	26.41	8, . .	29.25	-	30.67
14, . .	18.75	26.20	23.00	15, . .	22.50	-	25.56
21, . .	9.75	17.46	-	22, . .	27.75	17.46	17.64
28, . .	24.00	26.92	22.15	29, . .	16.50	29.01	19.59
March 7, . .	19.50	14.55	15.34	Sept. 5, . .	18.00	16.74	-
14, . .	28.50	16.74	25.56	12, . .	13.50	17.50	-
21, . .	12.75	19.19	19.60	19, . .	12.75	19.65	23.00
28, . .	12.75	20.38	25.56	26, . .	18.75	14.56	18.74
April 4, . .	15 00	18 92	23.86	Oct. 3, . .	16.50	17.46	14.48
11, . .	19.50	14.55	19.60	10, . .	8.36	14.61	15.66
18, . .	21.75	19.65	28.96	17, . .	10.64	17.86	26.97
25, . .	10.50	22.56	21.15	24, . .	14.44	12.98	13.92
May 2, . .	16.50	13.83	19.59	31, . .	12.16	21 11	19 14
9, . .	15.75	13.83	19.59	Nov. 7, . .	12.16	22.73	15.66
16, . .	25.50	21 83	22.15	14, . .	11.40	23.54	21.75
23, . .	13.50	16 01	16.19	21, . .	17.48	16.24	19.14
30, . .	12.00	11.64	21.30	28, . .	15.96	20.29	7.83
June 6, . .	9 00	20.37	17.89	Dec. 5, . .	12.92	12.11	19.14
13, . .	15.75	9.46	15.34	12, . .	17.86	15.41	27.84
20, . .	17.25	27.65	19.59	19, . .	19.00	14.61	25.58
27, . .	13.50	16.00	16.19	26, . .	12 62	12.18	10.44

Population of Worcester, ...	68,383
Death-rate, 1885, ...	17.38
" 1884, ...	19.74
Population of Lowell, ...	64,051
Death-rate, 1885, ...	18.45
" 1884, ...	22.17
Population of Cambridge, ...	59,660
Death-rate, 1885, ...	20.57
" 1884, ...	18.79



WORCESTER. ■ LOWELL. ■ CAMBRIDGE. ■



FALL RIVER. LYNN. LAWRENCE.

Mortality-rates of Cities.

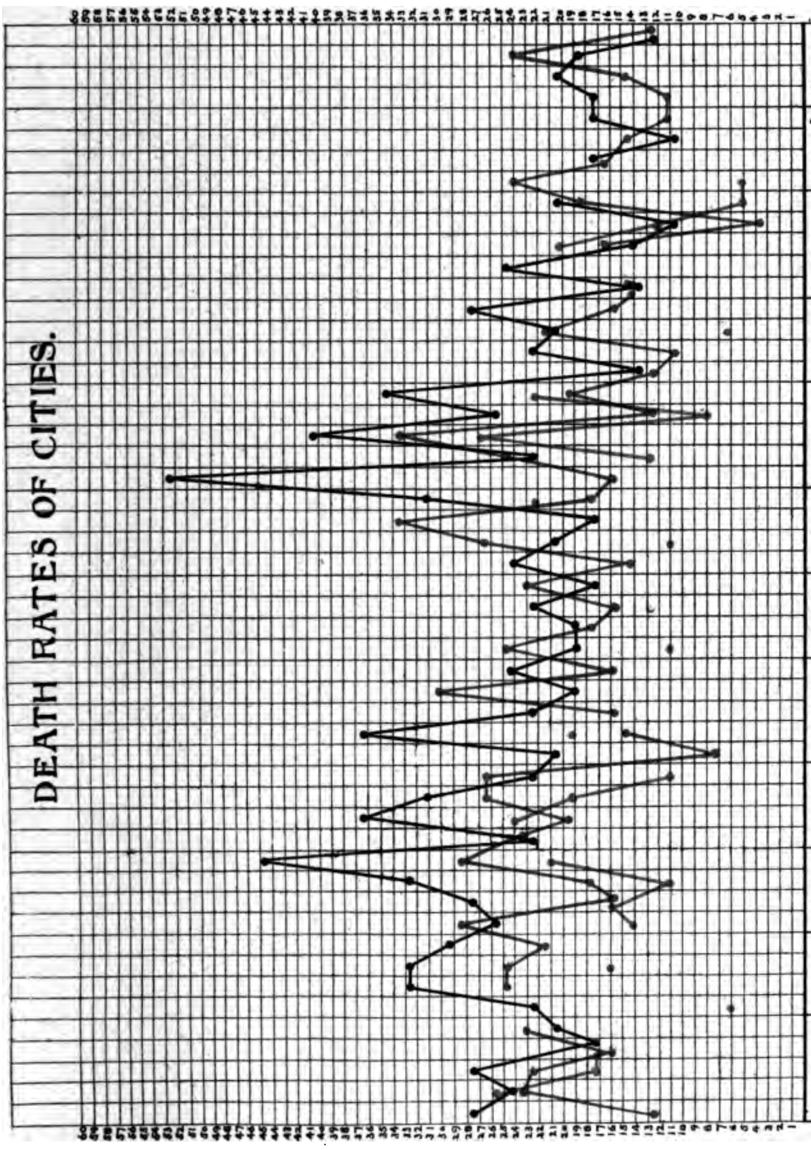
	Fall River.	Lynn.	Lawrence.		Fall River.	Lynn.	Lawrence.
Jan. 3, .	24.87	23.16	17.13	July 4, . .	14.92	6.98	13.70
10, . .	20.73	13.90	-	11, . .	-	16.21	20.56
17, . .	16 58	12.74	11.42	18, . .	24.87	13.68	28.55
24, . .	24.04	12.74	20.60	25, . .	31.50	18.90	12.56
31, . .	16.58	13.89	14.85	Aug, 1, . .	27.36	22.00	14.85
Feb. 7, . .	22 38	18.53	17.13	8, . .	22.38	28.95	19.41
14, . .	18.24	24.32	17.13	15, . .	24.04	25.48	23.98
21, . .	29.84	13.90	10.28	22, . .	26.53	20.00	17.13
28, . .	17 41	16.21	-	29, . .	28.92	28.95	13.71
March 7, . .	13.26	12.74	15.98	Sept. 5, . .	18.24	12.74	14.85
14, . .	25.70	8 11	15.98	12, . .	26 69	22 00	6.85
21, . .	34 02	25.47	27.41	19, . .	22.28	13.89	14.85
28, . .	20 73	12 74	11.42	26, . .	20.72	12.56	14.85
April 4, . .	22.38	19.60	12.56	Oct. 3, . .	14.92	19.58	10.28
11, . .	29 84	19.68	19 41	10, . .	17.35	-	6.60
18, . .	16.58	11 58	25.12	17, . .	15.54	12.43	-
25, . .	16 58	24.32	18.27	24, . .	23.76	11.30	5.36
May 2, .	13 26	-	21.70	31, . .	10.98	10.71	-
9, . .	14.09	17.37	22.82	Nov, 7, . .	14.62	15.82	12.02
16, . .	14.09	22.00	7.99	14, . .	11.98	16.95	18.76
23, . .	14.09	17.37	14.85	21, . .	14.62	10.17	10.72
30, . .	17.41	19.68	11.42	28, . .	19.19	-	-
June 6, . .	20.72	-	6.85	Dec, 5, . .	11.08	12.43	-
13, . .	13.26	13.81	7.99	12, . .	18 28	13.56	7.38
20, . .	13 26	-	11.17	19, . .	20 11	12.43	-
27, . .	15.41	11.58	11.42	26, . .	10.97	14.69	24.12

Population of Fall River, ...	56,863
Death rate, 1885, ...	19.55
" 1884, ...	24.74
Population of Lynn, ...	45,861
Death-rate, 1885, ...	16.68
" 1884, ...	15.65
Population of Lawrence, ...	38,825
Death-rate, 1885, ...	15.16
" 1884, ...	22.94

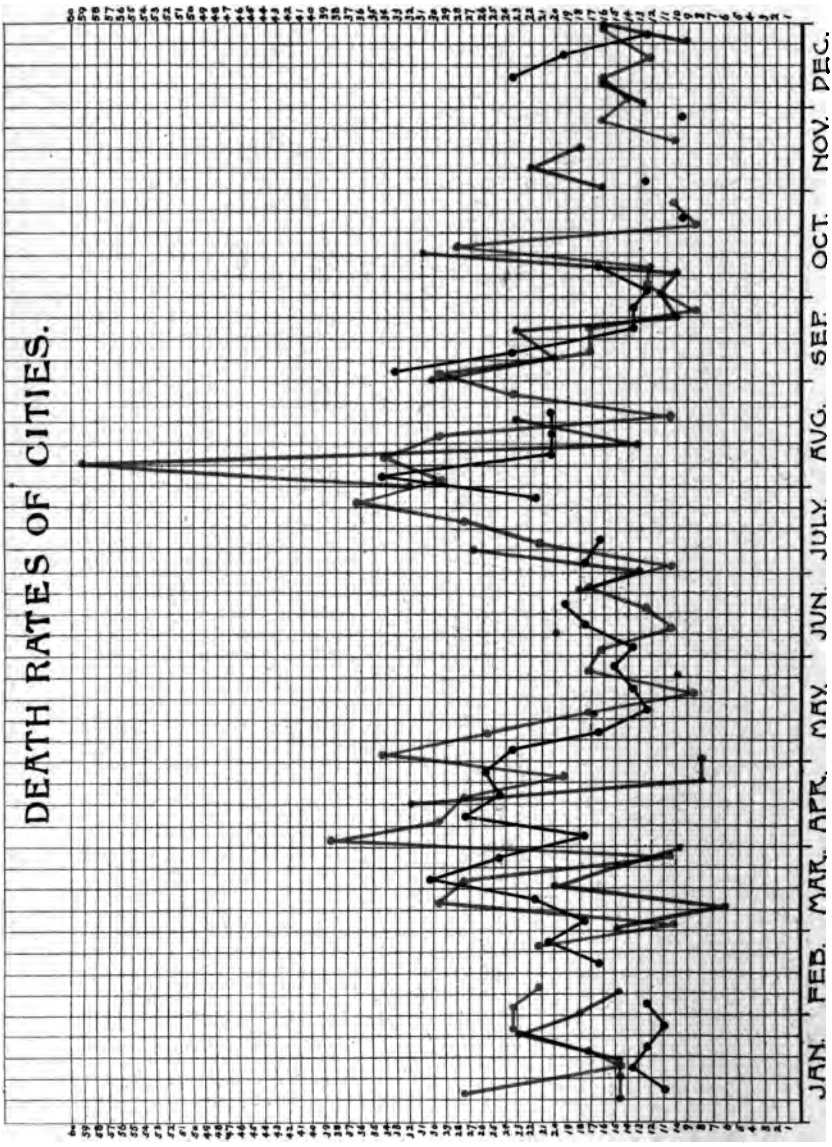
Mortality-rates of Cities.

	New Bedford.	Somerville.	Salem.		New Bedford.	Somerville.	Salem.
Jan. 3, . .	27.60	-	12.41	July 4, . .	24.15	-	14.18
10, . .	24.15	26.02	23.05	11, . .	20.70	11.38	26.59
17, . .	27.60	17.88	22.48	18, . .	17.25	-	33.69
24, . .	17.25	17.89	15.96	25, . .	31.05	22 86	17 73
31, . .	20.68	-	23.05	Aug, 1, . .	52.47	-	15.96
Feb. 7, . .	22 43	6.50	-	8, . .	22.43	13.01	24.82
14, . .	32.77	-	24.75	15, . .	40 40	27.02	33.69
21, . .	32.77	16.38	24.75	22, . .	25.88	8.13	12.41
28, . .	29.33	-	21 28	29, . .	34.50	22.76	19.50
March 7, . .	25.86	14.63	28.37	Sept. 5, . .	13.80	-	12.41
14, . .	27.60	16.26	15 96	12, . .	22.43	-	10.64
21, . .	32.77	11.38	17.73	19, . .	20.70	6.50	21.27
28, . .	44.85	21.16	28 37	26, . .	27.60	-	15.96
April 4, . .	22.43	-	23.05	Oct. 3, . .	13.80	14 64	14.18
11, . .	36.13	24.39	19.50	10, . .	24.91	-	-
18, . .	31.05	19.51	26.59	17, . .	14.01	20.88	16.65
25, . .	22.49	11.38	26.57	24, . .	10.89	12.18	3.70
May 2, . .	20.70	-	7.09	31, . .	20.23	5.22	18.50
9, . .	36.23	19.51	14.81	Nov. 7, . .	-	5.22	24.05
16, . .	22.43	-	15.96	14, . .	17.13	-	16.66
23, . .	18.98	-	30.14	21, . .	10.89	-	14 80
30, . .	24.15	-	15.96	28, . .	17 13	-	11.10
June 6, . .	18 98	11.38	24.82	Dec. 5, . .	17.13	-	11.10
13, . .	18.98	-	17.73	12, . .	20.23	-	14 80
20, . .	22.43	13.01	15.53	19, . .	18.68	-	24.05
27, . .	17.25	-	23.05	26, . .	12.46	-	12.95

Population of New Bedford, ...	33,393
Death-rate, 1885, ...	23.68
" 1884, ...	19.29
Population of Somerville, ...	29,992
Death-rate, 1885, ...	16.68
" 1884, ...	17.21
Population of Salem, ...	28,084
Death-rate, 1885, ...	19.21
" 1884, ...	20.90



NEW BEDFORD. ■ SOMERVILLE. ■ SALEM. ■



SPRINGFIELD. HOLYOKE. CHELSEA.

Mortality-rates of Cities.

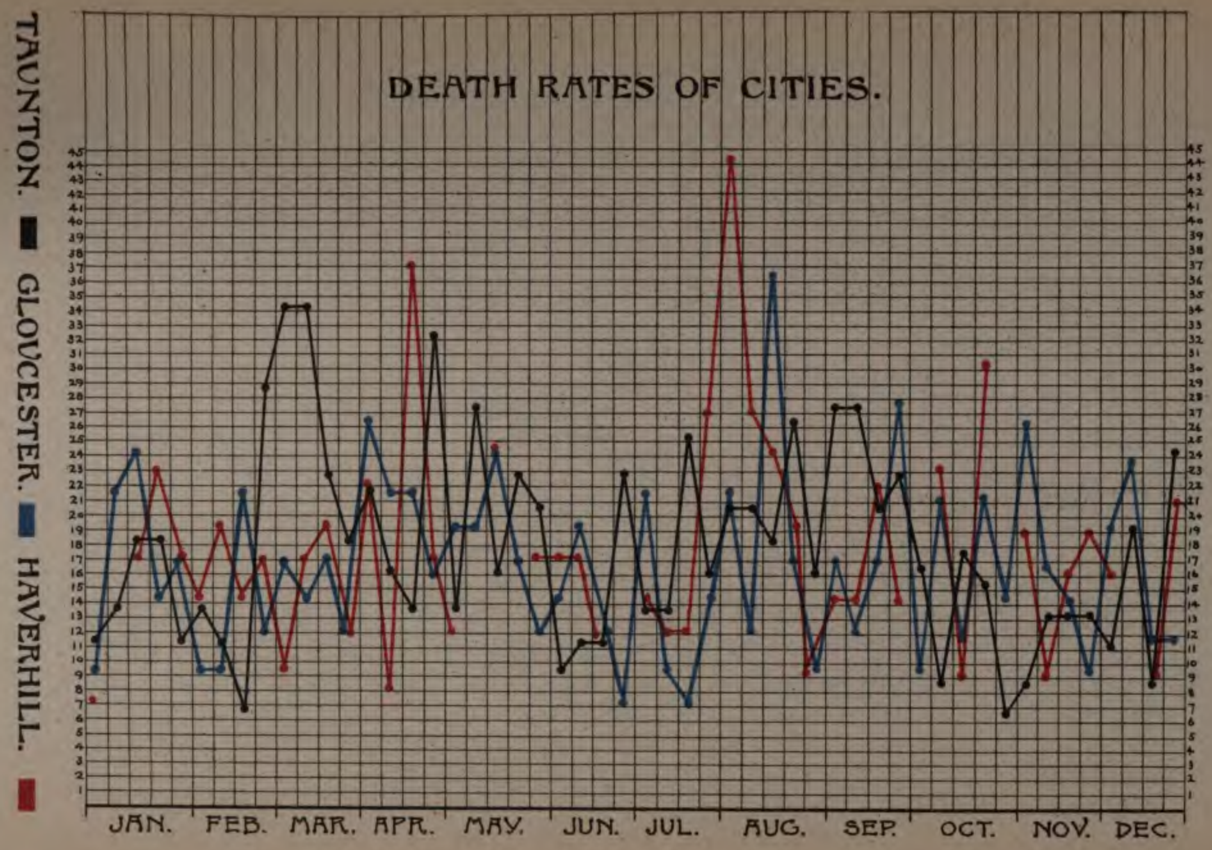
	Springfield.	Holyoke.	Chelsea.		Springfield.	Holyoke.	Chelsea.
Jan. 3,	-	15.34	-	July 4,	17.75	27.26	10.68
10,	10.92	15.34	27.76	11,	16.38	-	21.22
17,	13.65	15.34	14.95	18,	-	35.78	27.77
24,	12.29	23.56	17.09	25,	21.84	32.38	36.31
31,	10.92	18.74	23.50	Aug. 1,	34.13	59.64	29.96
Feb. 7,	12.29	15.34	23.50	8,	20.47	13.63	34.18
14,	-	-	21.36	15,	20.47	23.86	29 90
21,	16.26	-	-	22,	20.47	-	10.88
28,	20.48	15.34	21.36	29,	-	30.76	23 49
March 7,	17.65	6.82	10.09	Sept. 5,	30.03	20.45	29.90
14,	21.84	20.45	29.90	12,	23.57	23.87	17.09
21,	30.03	15.34	27.77	19,	13.65	10.42	17.09
28,	24.57	10.22	10.68	26,	13.65	11.93	8.54
April 4,	17.75	-	38.45	Oct. 3,	12.29	10.22	12.82
11,	27.30	32.37	29.92	10,	16.61	31.28	12.12
18,	24.57	8.52	27.77	17,	-	-	28.28
25,	25.93	8.52	19.26	24,	9.69	-	8.08
May 2,	23 21	-	34.18	31,	-	16.78	10.10
9,	16.38	17.04	25.63	Nov. 7,	12.64	22.38	-
16,	12.29	-	17.09	14,	-	18.40	-
23,	13.65	10.22	8.54	21,	-	-	10.10
30,	15.02	-	17.09	28,	9.69	13.06	16.16
June 6,	13.65	20.45	16.09	Dec. 5,	-	16.79	14.14
13,	17.74	-	10.68	12,	23.53	-	16.16
20,	19.11	18.74	12.82	19,	19.37	9.33	12.12
27,	-	13.63	17.09	26,	12.46	16.77	16.16

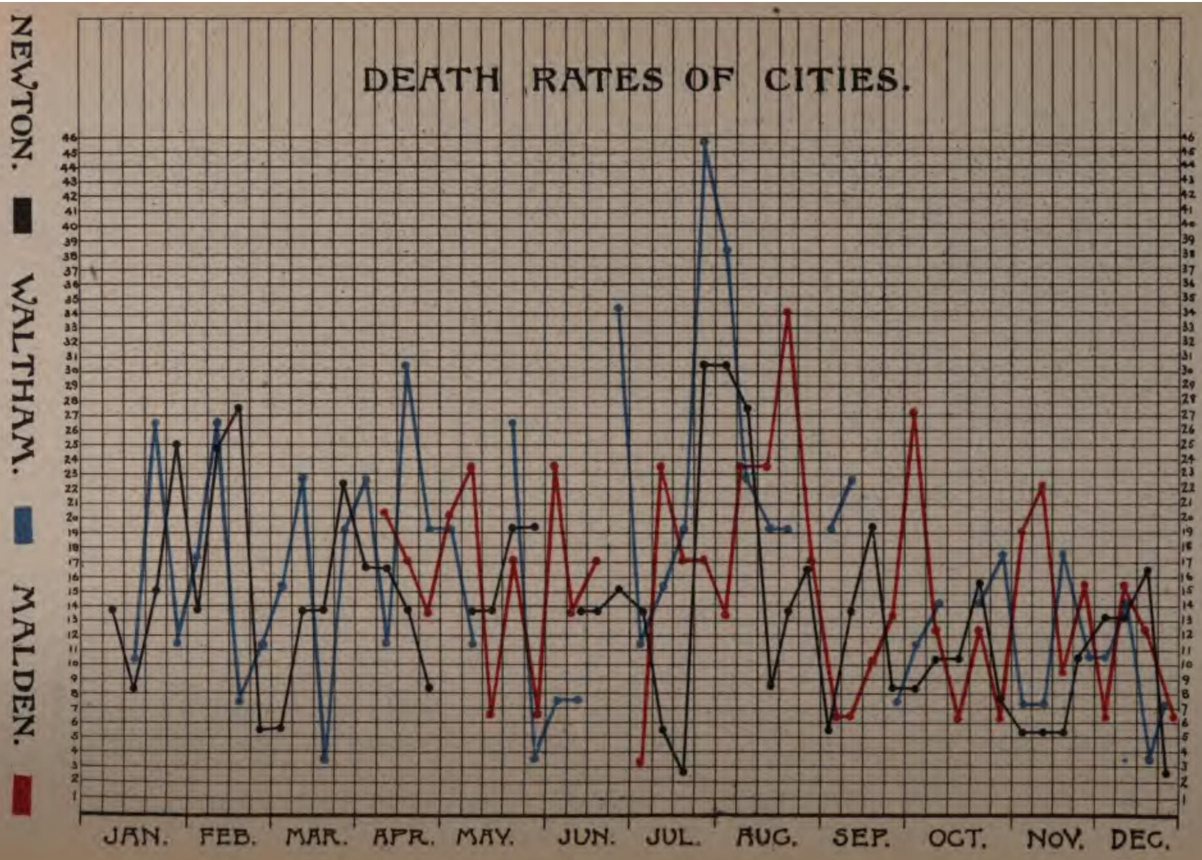
Population of Springfield,	37,577
Death-rate, 1885,	18.24
" 1884,	17.50
Population of Holyoke,	27,894
Death-rate, 1885,	19.14
" 1884,	20.86
Population of Chelsea,	25,709
Death rate, 1885,	19.49
" 1884,	18.33

Mortality-rates of Cities.

	Taunton.	Gloucester.	Haverhill.		Taunton.	Gloucester.	Haverhill.
Jan. 3, . .	11.46	9.72	7.46	July 4, . .	13.75	21.87	14.92
10, . .	13.75	21.87	-	11, . .	13.75	9.72	12.43
17, . .	18.34	24.30	17.41	18, . .	25.20	7.29	12.44
24, . .	18.34	14.58	23.38	25, . .	16.04	14.58	27 36
31, . .	11.46	17.01	17.41	Aug. 1, . .	20.62	21.87	44.76
Feb. 7, . .	13.75	9.72	14.92	8, . .	20.62	12.15	27.36
14, . .	11.46	9.72	19.89	15, . .	18.34	36.45	24.87
21, . .	6.87	21.87	14.92	22, . .	26.33	17.01	19.89
28, . .	28.78	12.15	17.41	29, . .	16.04	9.72	9.95
March 7, . .	34.36	17.01	9.95	Sept. 5, . .	27 49	17.01	14.92
14, . .	34.36	14.58	17.41	12, . .	27 49	12.15	14.92
21, . .	22.91	17.10	19.90	19, . .	20.61	17.01	22.38
28, . .	18.24	12 14	12.14	26, . .	22 91	26.73	14.92
April 4, . .	21.87	26.73	22.38	Oct. 3, . .	16.64	9.72	-
11, . .	16.04	21 87	8.46	10, . .	8.80	11.95	23.80
18, . .	13.77	21.87	37.31	17, . .	17.60	21.31	9.52
25, . .	32.06	16.01	17.41	24, . .	15.40	21.12	30.94
May 2, . .	13.75	19 44	12.44	31, . .	6.60	14.34	-
9, . .	27.49	19.44	-	Nov. 7, . .	8.80	26.29	19.04
16, . .	16.04	24.30	24.86	14, . .	13.12	16.73	9.52
23, . .	22.91	17.01	-	21, . .	13.20	14.36	16.66
30, . .	20.62	12.15	17.41	28, . .	13.20	9.56	19.04
June 6, . .	9.16	14.58	17.41	Dec. 5, . .	11.11	19.12	16.66
13, . .	11.46	19.44	17.41	12, . .	19.18	23.90	-
20, . .	11.46	12.15	12 44	19, . .	8.80	11.95	9.52
27, . .	22.91	7.29	-	26, . .	24.20	11.95	21.12

Population of Taunton, ...	23,674
Death-rate, 1885, ...	17.87
" 1884, ...	15.04
Population of Gloucester, ...	21,713
Death-rate, 1885, ...	16.73
" 1884, ...	20.06
Population of Haverhill, ...	27,795
Death-rate, 1885, ...	18.37
" 1884, ...	13.12


DEATH RATES OF CITIES.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
TAUNTON.
GLOUCESTER.
HAVERHILL.


DEATH RATES OF CITIES.
NEWTON.
WALTHAM.
MALDEN.
JAN.
FEB.
MAR.
APR.
MAY.
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.

Mortality-rates of Cities.

	Newton.	Waltham.	Malden.		Newton.	Waltham.	Malden.
Jan. 3, . .	-	-	-	July 4, . .	13 84	11.49	3.41
10, . .	13.84	-	-	11, . .	5.54	15 32	23.83
17, . .	8.30	10.49	-	18, . .	2.77	19.15	17.02
24, . .	15.07	26.81	-	25, . .	30.45	45.96	17.02
31, . .	25 00	11 49	-	Aug. 1, . .	30.45	38.30	13.62
Feb. 7, . .	13.84	17.32	-	8, . .	27.68	22 98	23 83
14, . .	24.92	26.81	-	15, . .	8 30	19 15	23.83
21, . .	27.68	7.66	-	22, . .	13.84	19.15	34.04
28, . .	5 54	11.50	-	29, . .	16.61	-	17.02
March 7, . .	5.54	15.32	-	Sept. 5, . .	5.54	19.15	6.81
14, . .	13.84	22.98	-	12, . .	13 84	22.98	6.81
21, . .	13.84	3.83	-	19, . .	19.38	-	10.21
28, . .	22 14	19.15	-	26, . .	8.31	7.66	13.62
April 4, . .	16.74	22.98	-	Oct. 3, . .	8.31	11.49	27.23
11, .	16 61	11.49	20.42	10, . .	10.52	14.24	12.68
18, . .	13.83	30.64	17.02	17, . .	10.52	-	6 34
25, . .	8.30	19.15	13.66	24, . .	15 78	14.24	12.68
May 2, . .	-	19.15	20.46	31, . .	7.89	17.80	6.34
9, . .	13.83	11.49	23.83	Nov. 7, . .	5.26	7.12	19.02
16, . .	13 83	-	6.81	14, . .	5.26	7.12	22.19
23, . .	19.38	26.81	17.02	21, . .	5.26	17.80	9.51
30, . .	19 41	3.83	6.81	28, . .	10.52	10.68	15.85
June 6, . .	-	7.66	23.83	Dec. 5, . .	13.15	10.68	6.34
13, . .	13.84	7.66	13.66	12, . .	13.15	14 24	15 85
20, . .	13.84	-	17.02	19, . .	16.58	3 56	12.68
27, . .	15.07	34.57	-	26, . .	2.63	7.12	6.34

Population of Newton, ...	19,759
Death-rate, 1885, ...	13.79
" 1884, ...	14 73
Population of Waltham, ...	14,609
Death-rate, 1885, ...	16.19
Population of Malden, ...	16,407
Death-rate, 1885, ...	15.27

The following cities and towns have contributed to the foregoing report: —

Cities and Towns.	Population.	Towns.	Population.
Boston, ...	390,406	Arlington, ...	4,673
Cambridge, ...	59,660	Millbury, ...	4,555
Fall River, ...	56,863	W. Springfield, . . .	4,448
Lynn, ...	45,861	Winchester, ...	4,390
New Bedford, ...	33,893	Canton, ...	4,380
Somerville, ...	29,992	Lee, ...	4,274
Salem, ...	28,084	North Brookfield, . . .	4,201
Chelsea, ...	25,709	Amherst, ...	4,199
Gloucester, ...	21,713	Hudson, ...	3,968
Newburyport, ...	13,716	Hopkinton, ...	3,922
Worcester, ...	68,383	Bridgewater, ...	3,827
Lowell, ...	64,051	Randolph, ...	3,807
Lawrence, ...	38,825	Northbridge, ...	3,785
Springfield, ...	37,577	Concord, ...	3,727
Holyoke, ...	27,894	Whitman, ...	3,595
Taunton, ...	23,674	North Andover, . . .	3,425
Haverhill, ...	21,795	Bradford, ...	3,106
Brockton, ...	20,783	Mansfield, ...	3,939
Newton, ...	19,759	Holliston, ...	2,926
Malden, ...	16,407	Leicester, ...	2,923
Fitchburg, ...	15,375	Dudley, ...	2,742
Waltham, ...	14,609	Lexington, ...	2,718
Northampton, ...	12,896	Wrentham, ...	2,710
Attleborough, ...	13,175	Pepperell, ...	2,587
Woburn, ...	11,750	Needham, ...	2,586
Chicopee, ...	11,528	Merrimac, ...	2,378
Quincy, ...	12,144	Oxford, ...	2,355
Weymouth, ...	10,740	Chelmsford, ...	2,304
Peabody, ...	9,530	Upton, ...	2,265
Milford, ...	9,343	Westford, ...	2,193
Clinton, ...	8 945	Dalton, ...	2,113
Brookline, ...	9,195	Lancaster, ...	2,050
Westfield, ...	8,961	Groton, ...	1,987
Spencer, ...	8,247	Northborough, ...	1,858
Melrose, ...	6,101	Townsend, ...	1,846

Cities and Towns	Population.	Towns.	Population.
Wakefield, ...	6,060	Acton, ...	1,785
Andover, ...	5,711	West Brookfield, . . .	1,747
Stoneham, ...	5,652	Hadley, ...	1,747
Middleborough, . . .	5,173	Norton, ...	1,718
Westborough, ...	4,880	Northfield, ...	1,705
Marblehead, ...	7,518	Longmeadow, ...	1,677
Plymouth, ...	7,239	Conway, ...	1,573
Salisbury, ...	4,840	Westminster, ...	1,556
Provincetown, ...	4,840	Shrewsbury, ...	1,450
Hingham, ...	4,375	Cheshire, ...	1,448
Nantucket, ...	3,143	Sterling, ...	1,331
Fairhaven, ...	2,880	Hubbardston, ...	1,303
Harwich, ...	2,783	Auburn, ...	1,268
Cohasset, ...	2,216	Huntington, ...	1,267
Chatham, ...	2,028	Bellingham, ...	1,198
Yarmouth, ...	1,856	Harvard, ...	1,184
Manchester, ...	1,638	Topsfield, ...	1,141
Braintree, ...	4,040	Rutland, ...	963
Edgartown, ...	1,165	Lincoln, ...	901
Truro, ...	972	Bolton, ...	876
Brewster, ...	934	Burlington, ...	604
Cottage City, ...	709	Wendell, ...	509
Swampscott, ...	2,471	Prescott, ...	448

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Milford,	9,343	Westford,	2,193
Clinton,	8 945	Dalton,	2,113
Brookline,	9,195	Lancaster,	2,050
Westfield,	8,961	Groton,	1,987
Spencer,	8,247	Northborough,	1,853
Melrose,	6,101	Townsend,	1,846

Cities and Towns	Population.	Towns.	Population.
Wakefield, ...	6,060	Acton, ...	1,785
Andover, ...	5,711	West Brookfield, . . .	1,747
Stoneham, ...	5,652	Hadley, ...	1,747
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Brewster, ...	934	Burlington, ...	604
Cottage City, ...	709	Wendell, ...	509
Swampscott, ...	2,471	Prescott, ...	448

THIRD AND FINAL REPORT

OF THE

HEALTH DEPARTMENT,

TO THE

STATE BOARD OF HEALTH, LUNACY AND CHARITY,

OF THE WORK DONE IN COMPLIANCE WITH
THE STATUTES RELATIVE TO THE

ADULTERATION OF FOOD AND DRUGS.

INSPECTION OF FOOD AND DRUGS.

To the Hon. CHARLES F. DONNELLY,
Chairman of the State Board of Health, Lunacy and Charity.

SIR: — I have the honor to present herewith a report of the transactions of the Health Department for the year 1885, in compliance with the requirements of the statutes relative to the inspection of Food and Drugs. (Acts of 1884, chap. 289, sect. 2.)

In consequence of the termination of the duties of this Department, by virtue of the enactment of chap. 101 of the Acts of 1886, and also in compliance with a vote of the Board, I have included in this report the work of the first five months of the present year.

A brief summary of the work done in 1885 was published in the Seventh Annual Report of the Board (pp. lxi–lxvi), and is herewith repeated, for the sake of comparison, and the summary of the operations of the remaining months up to June 1, 1886, are also appended: —

SUMMARY.	Years.				Totals.
	1883.	1884.	1885.	1886, to May 31.	
Number of samples of food examined,	695	1,962	3,771	2,258	8,686
" " " found to be pure,	363	779	2,180	1,416	4,738
" " " found to be adulterated or not conforming to the statutes,	332	1,183	1,591	842	3,948
" " milk examined (included above),	218	1,123	2,219	1,445	5,005
" " " above standard,	35	347	1,297	904	2,583
" " " below standard,	183	776	922	541	2,422
" " drugs examined,	603	682	1,007	600	2,892
" " " of good quality,	357	431	571	307	1,666
" " " adulterated as defined by the statutes,	246	251	436	293	1,226
Total examinations of food and drugs,	1,298	2,644	4,778	2,858	11,578
" " " " of good quality,	720	1,210	2,751	1,723	6,404
" " " " not conforming to the statutes,	578	1,434	2,027	1,135	5,174
Expense of examinations and prosecutions,	$2,931 56	$5,529 60	$8,557 43	$5,964 84	$22,983 43

The work of the Department in this direction may be conveniently classified under three topics, as follows: —

1. Food, in general, with the exception of milk.
2. Milk.
3. Drugs.

The following officers have acted under the direction of the Board during the years 1885 and 1886: —

Dr. EDWARD S. WOOD, Analyst of Food.

Dr. BENNETT F. DAVENPORT, Analyst of Drugs.

Dr. CHARLES HARRINGTON, Analyst of Milk.

Prof. CHARLES A. GOESSMANN, Analyst of Milk.

Mr. CHARLES P. WORCESTER has also been employed during the year as an assistant in the department of milk inspection.

The duty of collecting samples has been very efficiently performed by the inspectors, Mr. JOHN H. TERRY of Boston and Mr. JOHN F. McCAFFREY of Lowell. The regulations which were adopted by the Board in 1882, and revised in 1884, have been carefully observed and have proved very useful in aiding and systematizing the work of inspection and analysis.

The inspectors have become more familiar with the legal processes necessary for the prosecution of offenders, so that there has been but little need of resort to the employment of counsel during the year.

One case only has presented any complications which required its reference to the Board, and such reference was made at the request of the parties against whom complaint was made.

The plan of issuing warning notices has been continued, and has proved very satisfactory in its operation, such notices being sent as usual to retailers, from whose hands they very soon reach the actual offenders, often through the medium of third and fourth parties, or middlemen. In this manner it is not an unusual occurrence for the Department to receive intelligence of the receipt of these notices from distant States, south and west.

The number of such notices issued during the period comprised within this report was 1,031, of which number 583

were for articles of food not including milk; 253 were for adulterated milk, and 195 for adulterated drugs.

The articles of food and drugs found to be adulterated, and in consequence of which such notices were issued, will be specified under their appropriate topics or groups, and also the cities and towns to which such notices were sent.

The salutary effect of the enforcement of the present statutes is felt, not only in Massachusetts, but also in other places which to a considerable extent furnish to this State many of the drugs in constant use.

As an illustration of the operation of the law in this direction, the following extracts from correspondence are presented, relative to the effect of the Food and Drugs Acts upon the quality of goods coming from sources outside of Massachusetts.

Some samples of drugs were obtained at a retail shop in one of the cities of the State, a portion of which were found to be adulterated, and in compliance with the usual custom a notice of the fact was sent to the proprietor, who carefully traced the fault to its source, and wrote to us as follows: —

"Out of a great number of prescriptions in the year 1885, citrate of iron and quinine was one of those most commonly prescribed. As to the wine, I shall transmit to you soon the answer of my wholesale dealer. Once more I thank you for your kindness, and believe me . . . Yours, etc.,

. . . ."

Enclosed was a letter from the wholesale dealer to the retail druggist of whom the first named article was purchased by the retail druggist: —

"Your letter is before me, and contents noted. I am sorry the answer to your complaints has been so long delayed. . . . As to the citrate of iron and quinine, we enclose a letter from the manufacturer, to whom we wrote as soon as we heard of the trouble. We supposed that the article was all right, but should suggest that, in future, we send you only . . .'s citrate of iron and quinine, which we know to be all right, or as near as it can be made, but which *will cost you a little more money.* We only propose to sell pure goods, unless our customers will have a cheaper

article, when they must take the consequences. In this case, however, we supposed it was all right."

The following is the manufacturer's letter referred to by the wholesale dealer: —

"DEAR SIR: —Yours of the 3d to hand. We are certainly very sorry to hear of complaint. We are at a loss to give a satisfactory reason for the deficiency in the quality of our citrate of iron and quinine. We would say, however, that such a result is contrary to our purpose and expectation in conduct of our business. Many competitive brands of quinine have made their way into the market, and as a matter of business economy we bought variously, and may have at times been deceived as to quality, although, when the prices would at all admit of it, have used only the best known make.

"Possibly a miscalculation or mistake might have occurred in manipulation.* (It would be impracticable to analyze after each product.) Whatever the cause, it was wholly unintentional and we will see to it that there shall be no grounds for complaint hereafter. We would say that the parcel referred to be returned at our expense and satisfactorily replaced.

"We would cheerfully make good any fault at any time in this or any of our preparations. As this is the first time our preparation has been called to account, and as such eminent firms as . . . & . . . and others have found themselves (in Massachusetts) in the same predicament, we are still sanguine of maintaining the confidence of the trade. Yours very respectfully,

. . . . ."

Soon after the receipt of the above correspondence the wholesale dealer who furnished the wine (also referred to in the foregoing correspondence) called in person at the office of the Health Department, to make inquiry with reference to the specific form of adulteration which had been found to exist in the sample of wine in question, and expressed his intention to furnish in future, so far as druggists were concerned, only such wines as should conform to the requirement of the statutes.

* This might be true in the case of slight variations from the Pharmacopœial standard, but in this instance the article in question contained 7.4 per cent. only of quinine, the amount required being 12 per cent. Too much variation to be attributed to accidental causes.

This correspondence also illustrates a point already known to many, that certain manufactured drugs are prepared for sale of various grades, qualities or strengths. Fortunately, however, for the consumer in Massachusetts, so far as officinal drugs are concerned, the Pharmacopœia provides one standard, that of purity; and in many instances of preparations containing valuable ingredients, the relative proportions of such ingredients are expressed with mathematical exactness.* Drugs, therefore, which are bought and sold within the limits of the State must conform to such standard, unless the purchaser calls for an article inferior to such standard, or unless the difference of such article from the standard is made known to the purchaser at the time of sale. (Acts of 1884, chap. 289, sect. 7.)

Similar correspondence in the possession of the Board also illustrates the salutary operation of the law with reference to many articles of food, notably of spices and other articles manufactured outside of the State.

The following letter has reference to certain articles in common use. The mustard in this instance was largely adulterated with starch, and the sample purchased as cream of tartar contained but 22½ per cent. of that substance. A good cream of tartar should contain at least 95 per cent. of the substance whose name it bears: —

"DEAR SIR: — Yours at hand. Would say we have bought our cream of tartar and mustard of . . . of . . , New York, for the past 25 years, and supposed we were buying absolutely pure articles. We have shipped all goods in stock back to above parties. Respectfully yours,

. . . ."

* For example, the standard of Tincture of Opium, and also of Deodorized Tincture of Opium, requires the presence of not less than 1.2 per cent., and not more than 1.6 per cent., of morphia. The Citrate of Iron and Quinine must contain 12 per cent. of quinine. Compound Spirits of Æther must contain 3 per cent. of ethereal oil, etc., etc.

Food.

The articles of food which have been examined during the period comprised in this report have been the following.

Samples of the following articles were found to be adulterated: —

Lard.
Butter.
Cheese.
Honey.
Black Pepper, in powder.
White " "
Mustard, in powder.
Mace, "
Cassia, "
Cinnamon, "
Ginger, "
Cloves, "
Allspice, "
Cream of Tartar.
Vinegar.
Coffee.
Tea.
Baking Powders.
Lemon Juice.
Arrowroot.
Molasses.
Maple Sugar.
Maple Syrup.

Yellow Sugar (colored with poisonous pigment).
Confectionery of various sorts (colored with poisonous pigments.)
Olive Oil.
Isinglass.
Canned goods.
" Tomatoes.
" Peas.
Pickles.
Jellies.
Strawberry.
Raspberry.
Pineapple.
Grape.
Currant.
Orange.
Peach.
Blackberry.
Lemon.
Quince.
Crab Apple.

Samples of the following articles examined were found to be free from adulteration: —

Buckwheat.
Oatmeal.
Buttered Flour.
Brown Bread Mixture.
Tapioca.
Cornstarch.
Gelatine.
Soda.
Saleratus.
Canned Beans.
" Lobster.
Cocoanut, desiccated.

Poultry Dressing.
Table Salt.
Vermicelli.
Brown Sugar.
Granulated Sugar.
Powdered "
Blue Sugar,
Red "
Green "
These were not colored with poisonous pigments.
Chocolate.
Horseradish.

The foregoing articles were obtained in the following cities and towns: —

Boston.
Worcester.
Lowell.
Cambridge.
Fall River.
Lynn.
Lawrence.
Springfield.
New Bedford.
Somerville.
Holyoke.
Salem.
Chelsea.
Chicopee.
Taunton.
Haverhill.
Gloucester.
Brockton.
Newton.
Malden.
Fitchburg.
Waltham.
Newburyport.
Adams.
Athol.
Amherst.
Ayer.
Brookline.
Clinton.
Concord.
Cottage City.
Dunstable.
Everett.
Great Barrington.
Greenfield.
Leominster.
Medford.
Methuen.
Nantucket.
North Adams.
Northborough.
Natick.
Pittsfield.
Provincetown.
Plymouth.
South Adams.
South Framingham.
Stoneham.
Wakefield.
Winchester.
Ware.
Watertown.
Westfield.

Vinegar. — The inspection of this article has been continued in the same manner as during the preceding year, and notwithstanding the reduction in standard from 5 per cent. of acetic acid to 4½ per cent., as provided by the statute of 1885, the average quality of the samples taken by the inspectors has been considerably higher than that of 1884. This result has doubtless been effected by a more careful inspection of the article in question, notices having been sent to parties found to be selling vinegar below the required strength.*

While it is true that cider-vinegar, made by perfectly natural processes, may undoubtedly occasionally fall below

* In consequence of frequent inquiries for ready methods, and convenient apparatus for the purpose of testing the quality of vinegar, the desired information may be found in Appendix A.

the requirements of the law, it is also true that, with proper care in the selection of fruit with reference to its quality, and by the use of proper methods in converting it into vinegar, the standard required by the statutes may be easily attained. In this connection the recent inquiries of Prof. C. A. Goessmann of the Massachusetts Agricultural College are valuable, as illustrating the necessity of a proper choice of season for gathering fruit for the purpose of vinegar-making: —

BALDWIN APPLES.

DATE OF GATHERING AND ANALYSIS.	Specific Gravity of Juice at 12° to 15° C.	Percentage of Sugar in Juice.
September 1, ...	1.055	3.09
October 9, ...	1.065	6 25
November 27, ...	1.075	10.42

RHODE ISLAND GREENINGS.

DATE OF GATHERING AND ANALYSIS.	Specific Gravity of Juice at 12° to 15° C.	Percentage of Sugar in Juice.
September 1, ...	1.055	3.16
October 9, ...	1.066	7.14
November 27,*	1.080	11.36

The same report also adds: —

"The farther the apples are advanced toward maturity, the more sugar is found in the juice, the more alcohol can be produced subsequently by fermentation, and ultimately the more acetic acid will be obtained in an equally well-managed vinegar factory. The attainable quantity of alcohol in the cider, and of acetic acid in the cider vinegar, stands in a direct relation to the percentage of sugar in the apple juice. As each variety has its own time for maturing fully, independent of season, much advantage may be gained by assorting the apples before they are sent to the mill, with reference to that condition."

* This sample was gathered October 9, and kept carefully wrapped in a paper in a close box and tested November 29. The remaining five samples were gathered and tested on the date given.

Milk.

The regular work of inspection has been conducted throughout the year in the cities and principal towns of the State. Constant improvement is noted as an effect of the continuous execution of the law by the inspectors of the State Board. The quality of the work done by local inspectors has also improved in consequence of the appointment in several cities and towns of officers whose training has qualified them for efficient work. During the past two years several prosecutions have been conducted by local inspectors in cities and towns outside of Boston, an event of rare occurrence in previous years.

The total number of prosecutions conducted by the Health Department for violation of the laws relative to the inspection and adulteration of milk during 1885 was 54, and for the first five months of 1886 there were 14, making in all 68 cases within the time included in this report.

More definite information relative to these cases may be found upon p. 88.

Milk of Known Purity. — In addition to the regular work of inspection of commercial or market milk, as offered for sale, the Board has also continued during the year 1885 its examinations of the milk of animals as produced in various parts of the State, both at private farms and at public institutions.

The results of that inquiry were published in a pamphlet entitled "Results of Inquiries conducted by the Health Department of the State Board of Health, Lunacy and Charity, relative to the Quality of Milk as produced in Massachusetts."

Without repeating the minuter details of that inquiry, the summary is herewith presented, since it forms a valuable contribution to the work already published upon this subject.

A few additional analyses, made more recently, may be found in Dr. Harrington's report: —

"The following observations have been made under the direction of the Health Department of the State Board of Health, Lunacy

and Charity, with reference to the quality of milk as produced by herds and by single animals in the State of Massachusetts. The term "known purity" is used to designate such milk as has been obtained by the inspectors, or other authorized agents of the Board, each sample having been procured by them at the dairies, or stables where the milk was produced, the agents or inspectors being required to witness the milking of each animal, whose product was submitted to analysis.

"The analyses were made at the laboratories of the Harvard Medical College and of the Massachusetts Agricultural College by the analysts of the Board, Dr. Charles Harrington and Prof. C. A. Goessmann.

"For convenience of reference the samples were classified as follows: —

"1. Milk of single animals, each sample representing an average specimen of the whole quantity of milk produced at a single milking.

"2. Mixed milk of herds or dairies; each sample representing the milk obtained at one milking from two or more animals. The total number of samples of this sort was 54, obtained from an aggregate of 386 animals, being an average of seven in each herd or dairy.

"The results were still further classified with reference to the source of production; the milk produced at the farms of public institutions being tabulated separately from that produced at private farms or dairies.

"The following items were given in the tables presented: —

1. The time of year and also of the day.
2. The place where the sample was obtained or produced.
3. Age of animal.
4. Time since calving.
5. Breed.
6. Character of feed.

Results of Analysis.
7. Fat.
8. Solids, not fat.
9. Total solids.
10. Water.
11. Ash.
12. Averages of herds or dairies.

"The summary of the results was as follows: —

Samples obtained from single animals supplying public institutions,	116
" " " " at private farms, . . .	95
Total of samples from single animals, ...	211
Total number of single animals represented, ...	209
Mixed samples obtained from public institutions, ...	9
" " " from private farms, ...	45
Total number of samples of mixed milk, ...	54
" " of animals represented producing mixed samples,	386
Average number of animals in each herd, ...	7
Average solids of samples from single animals in public institutions,	13.04
" " " " " at private farms, .	13.43
" " of all samples from single animals, . . .	13 21
Average solids of samples of mixed milk from public institutions,	12.92
Average solids of samples of mixed milk from private farms or dairies, ...	13.35
Average solids of all samples of mixed milk, ...	13.28
Average solids of all samples of milk obtained from public institutions, mixed and single (175 animals), ...	13.00
Average solids of all samples of milk obtained from private farms, mixed and single (426 animals), ...	*13 36*
Average solids of all samples of mixed milk and milk of single animals from all sources, ...	13.26
Total number of animals producing the same, ...	601

"The samples represented in this summary were produced by animals owned in eight different counties of the State, including the two largest milk-producing counties (Middlesex and Worcester), and considering the varying conditions of production, such as breed, age, time of day, and season of the year, character of feed, and other modifying circumstances, the result obtained — 13.36 per cent. of total solids — may be fairly considered as an average of the present milk-product as furnished by the 150,000 milch cows of Massachusetts.

"The difference in quality of the milk obtained from public institutions cannot materially affect this result, since the ratio of animals owned by them is less than one per cent. of the entire number in the State."

The following table includes the results of analyses of milk with reference to the breed of the animals from which it was taken : —

Number of Cows.	BREED.	Fat.	Solids, not Fat.	Total Solids.
11	Jersey, ...	4.34	9.70	14.02
93	Native, ...	3.31	9.77	13.09
30	Ayrshire, ...	3.35	9.73	12.97
51	Durham, ...	3.28	9.44	12.73
47	Holstein, ...	3.29	9.22	12.51

The warning notices of delinquency on the part of milkmen or retail dealers of any sort were sent to such parties in the following cities and towns : —

Boston.
Worcester.
Lowell.
Cambridge.
Fall River.
Lynn.
Lawrence.
Springfield.
Holyoke.
Somerville.
New Bedford.
Salem.
Chelsea.
Brockton.
Fitchburg.
Gloucester.
Waltham.
Malden.
Arlington.
Agawam.
Beverly.
Berlin.
Boylston.
Dedham.
Dracut.
Everett.
Hyde Park.
Ipswich.
Lancaster.
Marblehead.
Medway.
Natick.
Peabody.
Pittsfield.
Plymouth.
Provincetown.
Quincy.
Swansea.
Topsfield.
Westborough.
Winthrop.
Woburn.

Prosecutions were also conducted against parties as detailed in a later portion of this report.

Drugs.

The inspection of Pharmacopœial articles has been continued through the year. The experience of the preceding year having shown what articles were especially liable to adulteration, care was taken to make collections mainly of such articles as were most liable to error. The method of obtaining drugs upon written orders detailed in the last report has been continued throughout the year.

Notices were sent to parties selling adulterated drugs in the following cities and towns of the State during the period included in this report. These include nearly all of the places in which collections were made during the same time. There are about 150 towns in Massachusetts in which no drug-shops are located: —

Boston.	Blackstone.
Worcester.	Concord.
Lowell	Clinton.
Cambridge.	Dedham.
Gloucester.	Gardner.
Fitchburg.	Great Barrington.
New Bedford.	Greenfield.
Fall River.	Hyde Park.
Brockton.	Hudson.
Haverhill.	Ipswich.
Malden.	Leominster.
Lynn.	Milford.
Lawrence.	Marlborough.
Chelsea.	Marblehead.
Salem.	Middleborough.
Somerville.	Natick.
Waltham.	North Adams.
Springfield.	Northborough.
Holyoke.	Nantucket.
Fitchburg.	Provincetown.
Newburyport.	South Framingham.
Athol.	Stoneham.
Amherst.	Westfield.
Ayer.	Ware.
Adams.	

The articles found to be adulterated as defined by the statutes were as follows: —

Compound Spirits of Ether.
Spirits of Nitrous Ether.
Tincture of Opium.
Deodorized Tincture of Opium.
Powdered Opium.
Opium pills.
Brandy.
Whiskey.
White Wine.
Red Wine.
Sulphate of Quinine.
Cinchona Bark.
Citrate of Iron and Quinine.
Solution of Citrate of Iron and Quinine.
Solution of Chlorinated Soda.
Tincture of Iodine.
Tincture of Nux Vomica.
Oil of Anise.
Olive Oil.
Oil of Cloves.
Oil of Sassafras.
Oil of Bitter Almonds.
Oil of Juniper.
Oil of Fennel.
Oil of Lemon.
Oil of Cinnamon.
Oil of Cubebs.
Oil of Spearmint.
Oil of Theobroma.
Jalap.
Cochineal.
Saffron.
Precipitated Sulphur.
Honey.
Saccharated Pepsin.
Pepper.
Cinnamon.
Wine of Opium.
Bitter Wine of Iron.
Mustard.
Cream of Tartar.
Taraxacum.
Cloves.

A marked improvement has been observed through the year in the quality of many of the preparations obtained by the inspectors. Especially was this noticeable in the case of the preparations of opium.

In the preceding report none of the samples of powdered opium were of the required strength, while in the past year 31.7 per cent. of the samples were of the standard strength.

Of the samples of tincture of opium obtained in the preceding year, 19.6 per cent. were of the requisite strength. In the present report the number of samples found to be of the required strength was 35 per cent. of those collected.

Two other important articles are found quite uniformly below the standard of the Pharmacopœia, — the spirits of nitrous ether and the compound spirits of ether. The former important preparation invariably falls below the requirement, and it appears to be the opinion of experts that the method of analysis required by the Pharmacopœia is faulty, since by that method this drug, as made by the required process laid down upon the same page, will not conform to such standard. It is therefore desirable that a correct formula may be devised for that article, both as to its preparation and its analysis.

In the case of the compound spirits of ether, which is quite uniformly adulterated within the meaning of the statutes, the form of adulteration is none other than a commercial fraud. It is probable that the want of confidence in the employment of this excellent preparation is due to the almost universal practice of substituting some inferior article in place of its most important ingredient, the ethereal oil.*

Some of the fixed and volatile oils are also quite commonly adulterated; about 40 per cent. of the samples submitted to the analyst were found to be adulterated with rectified turpentine.

Jalap is found to be remarkably variable in its strength, some samples obtained having less than one-tenth of the required strength, to which fact must be undoubtedly attributed its frequent uncertainty of action.

Pharmacopœial Wines and Liquors.

Special attention has been given during the year to the quality of those wines and liquors which are prescribed as officinal. These are five in number, of which 106 samples were examined, 76 of them being spirits and 30 wines.

The requirements of the Pharmacopœia with reference to these articles are very accurately and carefully defined, among which are the following definite numerical provisions:

ARTICLE.	SPECIFIC GRAVITY.	PERCENTAGES.		RESIDUE.
		Alcohol by Volume.	Alcohol by Weight.	
Spiritus vini Gallici (brandy), . .	.925 to .941	46 to 55	39 to 47	.25
Spiritus frumenti (whiskey), . .	.917 " .930	50 " 58	44 " 50	.25
Vinum rubrum (red wine), . .	.989 " 1.010	-	10 " 12	1.6 to 3.5
Vinum album (white wine), .	.990 " 1.010	-	10 " 12	1.5 " [illegible]
Vinum album fortius (stronger white wine), . .	-	-	20 " 25	-

* "We cannot be surprised that the medicine, as obtained from different apothecaries, varies very much in its properties, and often disappoints the expectations of the physician. The chief excuse for the departure from the officinal directions is the costliness of the ethereal oil; but were this much greater than it really is, the excuse would not be valid; and it cannot be justified, on any principle of morality, to sell under the official title a preparation which has no claim to it whatever." — *U. S. Dispensatory, 15th ed., p. 1846.*

These requirements, as well as others prescribed in the U. S. Pharmacopœia, are such as are attainable by natural processes, and allow sufficient latitude for natural products.

The demand for Pharmacopœial wines, as above defined, for medicinal purposes is not large, the more common custom among physicians being to prescribe non-officinal brands. Since all of these preparations depend for their therapeutical effect mainly upon the alcohol which they contain, it is desirable that they should conform to the desired standard, so far as the percentage of alcohol present in them is concerned. Unfortunately, such is by no means the case, the samples obtained presenting variations from one half the required amount of alcohol up to five times the maximum requirement. This latter gross departure from the standard was evidently the result of unusual carelessness on the part of the vendor, who was justly submitted to prosecution, with the result of prompt conviction.

For Sherry, Madeira, Port, Claret and other wines the Pharmacopœia has no standard, and the same is true of rum and gin. In the case of Pharmacopœial brandy and whiskey the standard called for is that of purity, and nothing more. If the true therapeutic action of alcohol were better understood, there would undoubtedly be less demand for the multitude of sophistications which are constantly forced upon the attention of the profession, under the guise of aging, rectifying and improving processes, and various other specious and attractive names, and a resort to the simple Pharmacopœial spirits and wines would follow.

Of the seventy-six samples of spirits obtained by the inspectors, nine only conformed to the requirements of the statutes, the departure from the standard being almost exclusively in the addition of water, alcohol or of fruit sugars. The same was also true, in a still greater degree, of the wines, of which one only conformed to the strict requirement of the Pharmacopœia.

These examinations have also shown the falsity of a popular impression, which has been created and fostered by the ill-advised statements of public lecturers, and also in published documents, that the harmful effect of the habitual use of alcoholic stimulants is due to the adulterations to which

they are subjected, rather than to the alcohol which they contain. It is sufficient to say that such statements have no foundation in fact, nor are they in the interest of justice, temperance or truth.

The statement of Dr. Davenport upon this point is worthy of careful consideration, and in corroboration of the same may also be cited the *résumé* of Dr. G. K. Sabine in a similar direction.*

There is also abundant evidence to show that the adulteration of liquors was quite as common in the latter part of the last and in the early years of the present century as it is at the present day.

Non-pharmacopœial Articles.

In addition to the officinal articles examined and reported upon, two classes of preparations which properly come under the operation of the Food and Drug Acts have been the subject of special inquiry during the past year.

These articles are largely advertised and sold, and many of them are actively injurious to those who use them. The preparations referred to are hair-dyes, and the so-called "cures" for the opium and the alcohol habits.

Hair-dyes. — Many of these preparations contain greater or less quantities of salts of lead, upon which they depend for their efficiency in changing the color of the hair. The undoubted poisonous character of lead, especially in the form of its soluble salts, is too well known to be questioned. Poisoning occasioned by the use of drinking water conveyed through lead pipes has been occasionally reported in former years, and was made the subject of an investigation by the State Board of Health, a report upon the subject being presented in 1871. A case which recently occurred in the town of Ashburnham is also given in the present report.

It is not remarkable, therefore, that serious symptoms should occasionally result from the habitual use of a soluble salt of lead, applied to the skin, which must absorb a por-

* The Medico-Legal Relations of Alcoholism: Its Pathological Aspects. By Med. Examiner G. K. Sabine, M. D. — *Transactions of Mass. Medico-Legal Society. Vol. I., Nos. 3 and 5.*

ion of it. Deaths have been reported from its use. One s detailed in Virchow's Archiv., in which an autopsy re-vealed the presence of lead in the brain, after the use of a hair-dye containing it.

A second case of death is also reported in the Transactions of the Iowa Medical Society, 1867–71. Numerous cases of paralysis and other troubles are on record, resulting from the same cause.

The reasons for the occurrence of serious symptoms may be briefly stated as follows: —

1. Most of these preparations contain lead.
2. The salt of lead employed is soluble and also poisonous.
3. These preparations are used freely, the hair and scalp being saturated.
4. They are used for long periods of time.

By the slow and insidious absorption of the poisonous t of lead through the skin chronic lead-poisoning not un-quently results from the use of these articles. Many es of such injury are recorded. These facts are so well wn by the manufacturers of these articles that various terfuges are employed to conceal as much as possible r actual character. The term vegetable is occasionally ployed to designate an article, whose active ingredient poisonous mineral salt. Bottles containing such prepara-s not unfrequently are covered with a closely pasted er wrapper, extending to the top of the bottle, effectually cealing their contents from observation.

s a measure of protection to the public, such articles, if at all, should be required to bear a distinct label, stat-the ingredients which they contain.

n an appendix to Dr. Davenport's report (Appendix B) be found a list of hair-dyes examined, such as are found sale in the various drug-stores in the State.

he following list of references are offered in support of statements here presented. They include many reported s, and among them two autopsies in which lead was vered from the viscera, following the use of hair-dyes taining lead: —

Poisonous Hair-dyes. — References.

Taylor's Med. Jurisprudence, 4th Am. edition, p. 102.
London Med. Times, Aug., 1852.
Parkes' Hygiene, Wood's Am. edition, vol. 2, p. 121.
Phila. Med. and Surg. Reporter, vol. 21, Sept. 11, 1869.
Phila. Med. and Surg. Reporter, vol. 22, March 12, 1870.
Stille's Mat. Medica, vol. 1, p. 222.
Ziemssen's System of Medicine, vol. 17, p. 561.
Mass. State Board of Health Reports, vol. 2, p. 222, several cases.
Boston Journal of Chemistry, October, 1869, p. 37.
Boston Journal of Chemistry, April, 1870, p. 117.
Virchow's Archiv., Bd. 8, p. 177. Lead recovered from a portion of the brain following the use of a poisonous hair-dye.
Trans. Iowa Med. Soc., 1867-1871. Death from the use of a hair-restorer.
Chemical News, London, 1880, vol. 41, p. 278.
Boston Med. and Surg. Journal, 1872, vol. 86, p. 88.
Rec. d. trav. Comité consult. d'hygiène pub. de France, 1881, vol p. 352-355.
Annales d'hygiène, 1832, vol. 8, p. 324-335.
Allg. Wien. med. Zeitung, 1862, vol. 7, p. 221.
(Encephalopathia saturnina.)
London Lancet, 1867, p. 67.
Arch. f. pathol. Anatom., etc., 1860, vol. 18, p. 187-189.

Cures for the Opium and Alcohol Habits.

In the Third Annual Report of the State Board of Health of Massachusetts, a report upon the use and abuse of opium treats of two questions: —

1. The use of opium by the people; whether it is much used except to relieve pain?
2. Has it increased of late years? and if so, what is the cause of such increase?

The inquiry was directed to physicians and druggists, and does not appear to have been answered in a very satisfactory manner. Of the correspondents who replied to the second question, twelve were of the opinion that the habit was increasing, twenty-eight that it was not increasing, and six that it was diminishing. The general opinion among well-informed druggists was to the effect that it was increasing.

At this date, — fourteen years later, — this opinion appears to be confirmed, although the increase does not appear to be

so great as many popular writers upon the subject have represented.

The importations of the drug into the United States, as stated in the U. S. Commerce and Navigation Reports, were as follows, since 1870: —

In 1870,	254,609 pounds.	In 1878,	430,950 pounds.
1871,	315,121 "	1879,	405,957 "
1872,	416,864 "	1880,	533,451 "
1873,	319,134 "	1881,	318,710 "
1874,	395,909 "	1882,	370,249 "
1875,	305,136 "	1883,	457,499 "
1876,	388,311 "	1884,	331,172* "
1877,	349,223 "	1885,	384,434† "

From these figures a considerable amount should be deducted for opium which is re-exported.

This table includes only the crude drug and not its principal alkaloids, which are very largely used and have almost supplanted the crude drug for many purposes, especially in its employment by the general practitioner of medicine. The salts of morphia are also employed by persons who have acquired the opium habit, in consequence of their convenient form, ready solubility and adaptation to hypodermic employment.

One of the most evident proofs of an increase in the consumption of opium is the existence and growth of a considerable number of so-called "cures" or "antidotes" for the opium habit. These preparations are advertised broadcast in the public prints and occasionally in professional journals, which should serve a better purpose. If these so-called cures were of a similar composition to the great mass of empirical remedies, but little harm would result from their use. This is not the case, however, with the preparations in question. With but one exception, the active ingredient in the so-called cures examined by the analyst proved to be opium itself in one or another of its varied forms. The preparations of this character enumerated in the analyst's report were obtained, in all instances, either

* Of this amount 4,633 pounds was opium prepared for smoking.
† " " 50,265 " " " "

directly from the proprietors or from their authorized agents, and were accompanied with their published circulars.

The purchaser of such preparations thus becomes the victim of a cruel fraud, under the supposition that he is obtaining a remedy or antidote, the article which he receives being simply the enemy in disguise against which he is bending his energies to obtain relief. This shameful practice deserves nothing but the severest condemnation. To the credit of Massachusetts, but few, if any, of these preparations are made within its limits.

There is one notable exception to the above statement as to the presence of opium in these "cures," and that is the Chloride of Gold Cure, a preparation sold at an exorbitant price, doubtless in consequence of its alleged precious component. Reference to the analyst's statement, however, shows that this article contains not even a trace of that precious metal. Further comment upon this fraud is needless.

The results of the opium habit are known to all physicians in active practice, scarcely any one of several years' experience having failed to recognize this evil, to a greater or less degree, in his daily round of practice.

The cure of such cases, as is well known, especially of such as are of long standing, cannot be accomplished by mere medication, nor has any specific been discovered which will successfully relieve the sufferer from the opium habit. A cure must of necessity combine a treatment which deals with the entire physical and moral nature of the sufferer, and must be more thorough and far-reaching than any mere system of therapeutic drugging can possibly accomplish.

A list of the articles examined will be found in Appendix C.

The circulars referred to as accompanying the cures are omitted from this report, since no possible good would be accomplished by their publication. It is sufficient to say that their style is remarkably similar in their methods of securing and fleecing their victims, each one accusing the others of fraud, and publishing as endorsements the names of many prominent persons in various parts of the country. We have sufficient proof that in many instances such names were published without the least shadow of authority.

Prosecutions.

The whole number of prosecutions conducted and complaints entered by the Health Department of the Board from December 1, 1884, the date of the previous report, up to May 31, 1886, including those briefly reported in the Seventh Annual Report of the Board, was 119.

These were as follows, the articles found to be adulterated and the places where they were obtained being specified: —

Drugs.

For sale of adulterated drugs in Winthrop, . . .	1 case.

Food.

For sale of adulterated vinegar in Lowell, . . .	1 "
" " cream of tartar in Lowell .	1 "
" " " " in Springfield,	1 "
" " olive oil in Lowell, . . .	1 "
" " sugar in Worcester, . .	1 "
" " " in Pittsfield, . . .	3 cases.
" " " in Holyoke, . . .	1 case.
" " pepper in Lawrence, . .	1 "
" " " in Lowell, . . .	1 "
" " mustard in Fall River, . .	1 "
" " " in Pittsfield, . .	1 "
" " " in Lawrence, . .	1 "
" " " in Lowell, . . .	1 "
" " confectionery in Gloucester, .	1 "
" " " in Boston, .	2 cases.
Total, ...	18 "

Milk and Milk Products.

Butter.

For sale of adulterated butter in Springfield, . .	1 case.
" " " in Lowell, . . .	8 cases.
" " " in Cambridge, . .	2 "
" " " in Worcester, . .	3 "
" " " in Fall River, . .	3 "
" " " in Somerville, . .	1 case.
" " " in Boston, . . .	6 cases.
" " " " (Dorchester District),	1 case.
" " " " (S. Boston),	1 "
" " " in Salem, . . .	3 cases.
" " " in Ware, . . .	2 "
" " " in Fitchburg, . .	1 case.
Total, ...	32 cases.

Milk.

For sale of adulterated milk			in Boston,	5 cases.
"	"	"	in Cambridge,	2 "
"	"	"	in Somerville,	6 "
"	"	"	in Gloucester,	2 "
"	"	"	in Lowell,	2 "
"	"	"	in Fall River,	2 "
"	"	"	in Lawrence,	2 "
"	"	"	in Salem,	2 "
"	"	"	in Medford,	2 "
"	"	"	in Billerica,	2 "
"	"	"	in Holliston,	4 "
"	"	"	in Concord,	2 "
"	"	"	in Westborough,	3 "
"	"	"	in Marshfield,	1 case.
"	"	"	in Northborough,	2 cases.
"	"	"	in Dunstable,	2 "
"	"	"	in Weston,	2 "
"	"	"	in Medway,	3 "
"	"	"	in Medfield,	2 "
"	"	"	in Bolton,	2 "
"	"	"	in Lynn,	1 case.
"	"	"	in Brockton,	1 "
"	"	"	in Woburn,	1 "
"	"	"	in Nahant,	1 "
"	"	"	in Plymouth,	1 "
"	"	"	in Beverly,	1 "
"	"	"	in Nantucket,	1 "
"	"	"	in Bedford,	1 "
"	"	"	in Southborough,	1 "
"	"	"	in Upton,	1 "
"	"	"	in Warren,	1 "
"	"	"	in Hardwick,	1 "
"	"	"	in Stow,	1 "
"	"	"	in Shirley,	1 "
"	"	"	in Chelmsford,	1 "
"	"	"	in Westport,	1 "
"	"	"	in Walpole,	1 "
"	"	"	in Sudbury,	1 "

Total milk,	68 cases.
" butter,	32 "
" other articles of food,	18 "
" drugs,	1 case.
	119 cases.

In twelve of the foregoing cases the defendants were discharged, and in four the complaints were withdrawn. The

remainder were convicted, mainly in the district or municipal courts.

The entire number of prosecutions for adulteration of milk conducted by the Health Department since the enactment of the statutes giving authority to the Board, has been one hundred and sixteen. The samples of milk in these cases presented the following results on analysis: —

					No. of Cases.
Between	13	and	12	per cent. of total solids,	1
"	11½	"	12	" " "	13
"	11	"	11½	" " "	32
"	10½	"	11	" " "	30
"	10	"	10½	" " "	15
"	9½	"	10	" " "	9
"	9	"	9½	" " "	4
"	8½	"	9	" " "	5
"	8	"	8½	" " "	1
"	7	"	8	" " "	2
"	6	"	7	" " "	2
					114

Two prosecutions were also conducted for violations of other provisions of the statute having no reference to the standard.

The administration of the laws have thus far had an excellent effect, not only in improving the quality of food and drugs throughout the State, but also in stimulating greater efficiency in local inspection, which has been conducted in a much more thorough and satisfactory manner than at any previous time. In several cities local inspectors may now be found who are well trained for the work which they perform, and are doing efficient service for the protection of the respective municipalities which they represent.

SAMUEL W. ABBOTT,
Health Officer.

REPORT OF THE ANALYST OF FOOD.

BY PROF. EDWARD S. WOOD, M. D.

REPORT OF THE ANALYST OF FOOD.

BOSTON, MASS., May 31, 1886.

Dr. S. W. ABBOTT, *Health Officer*,
13 Beacon Street, Boston, Mass.

DEAR SIR: — I have the honor to present the following report on the examination of foods. Since the date of my last report, I have received from the inspectors of the Board 1,747 samples, 1,024 of which were found to be of good quality, and 723 to be adulterated. In view of the fact that the inspectors, in the exercise of their duty, are on the lookout for adulterated rather than for pure goods, these figures indicate a food supply of very good character. It is very gratifying to note that the percentage of adulteration detected in the goods of our own manufacturers and wholesalers has very steadily diminished, and that the retailers (particularly in the eastern part of the State) appear to deal in a generally higher class of goods. A very great proportion of the adulterated samples were obtained in the cities and towns in the western and south-western parts of the State, which, judging from the labels on spice packages, etc., are supplied mainly by New York and Connecticut dealers, who, unfortunately, can be reached only through the retailers.

The sale of "compound" goods seems to be gradually diminishing.

The samples examined comprise the following groups: —

BUTTER.

In the examination of the eighty-nine samples of butter two methods of analysis have been employed, — that of Hehner for the determination of the percentage of insoluble fat acids, the amount of which in pure butter-fat is never over 90 per cent., and that of Reichert for the estimation of the soluble fat acids, which are present in pure butter-fat

to such an extent that the amount yielded by 2.5 grammes of fat requires at least 12 c. c. of decinormal sodic hydrate solution for neutralization. The latter process is especially valuable for the examination of specimens which are mixtures of pure butter with the artificial product, and which, when examined by Hehner's process, would yield less than 90 per cent. of insoluble fat acids, thus ranking as good.

The following table shows the results obtained: —

Inspector's Number.	Percentage of Insoluble Fat Acids.	Amt. Decinormal Sodic Hydrate for Sol. Fat Acids from 2.5 Gm.	Remarks.
1602, . .	86.20	-	
1604, . .	-	-	Sold as oleomargarine, [illegible]bou wrapper not marked.
1606, . .	87.49	-	
1608, . .	86.21	-	
1820, . .	93.46	-	Adulterated.
1956, . .	95.13	-	Adulterated.
1958, . .	86.	-	
1960, . .	86.31	-	
1962, . .	88.11	-	
1964, . .	87.41	-	
1966, . .	94.40	-	Adulterated.
2356, . .	87.94	-	
2470, . .	86.54	-	
2474, . .	88.23	-	
2476, . .	93.76	-	Adulterated.
2524, . .	94.45	-	Adulterated.
2626, . .	89.15	-	
2628, . .	88.11	-	
2647, . .	93.50	-	Adulterated.
2818, . .	-	-	Sold as oleomargarine, wrapper not marked.
2984, . .	87.75	-	
3340, . .	86.55	-	
3906, . .	88 96	-	
3908, . .	85.74	13.7 c.c.	
3956, . .	93.64	3.0	Adulterated.
3958, . .	87.20	-	
3960, . .	91.08	11.6	"Lily of the Valley" — [illegible] nowledged to be adulter[illegible]
3962, . .	94.24	3.0	
5036, . .	-	9.1	Adulterated.
5056, . .	-	11 6	Adulterated.
5114, . .	-	14.5	
5116, . .	-	10.8	Adulterated.
5514, . .	-	1.4	Adulterated.
5516, . .	-	4.2	Adulterated. [illegible]
5517, . .	-	-	Sold as oleomargarine, wrapper not marked.
5525, . .	-	14.0	
5769, . .	87.23	-	
5771, . .	87.13	-	

R's t.	Percentage of Insoluble Fat Acids.	Amt. Decinormal Sodic Hydrate for Sol. Fat Acids from 2.5 Gm.	Remarks.
.	94.90	–	Adulterated.
.	86.67	13.0	
.	–	13.0	
.	–	14.1	
.	–	11.5	Adulterated.
.	–	12.8	
.	–	2.0	Adulterated.
.	–	8.6	Adulterated.
.	87.66	–	
.	95.07	–	Adulterated.
.	–	11.5	Acknowledged to be a mixture.
.	–	15.5	
.	–	4.	Adulterated.
.	–	12.4	
.	–	13.8	
.	–	14.1	
.	–	12.4	
.	–	1.6	Adulterated.
.	–	1.6	Adulterated.
.	–	1.8	Adulterated.
.	–	14.4	
.	–	–	Sold as butterine, but wrapper not marked.
.	–	1.4	Adulterated.
.	–	13.6	
.	–	13.0	
.	–	9.6	Adulterated.
.	–	–	Sold as butterine, but wrapper not marked.
.	–	2.5	Adulterated.
.	–	2.2	Adulterated.
.	–	2.0	Adulterated.
.	–	1.5	Sold as oleomargarine.
.	–	2.0	Adulterated.
.	–	13.0	
.	–	13.1	
.	–	4.0	Adulterated.
.	–	12.9	
.	–	13.0	
.	–	2.0	Adulterated.
.	–	5.5	Sold as pure, but wrapper marked "butterine."
.	–	15.0	
.	–	5.0	Adulterated.
.	–	14.3	
.	–	15.0	
.	–	13.4	
.	–	15.2	
.	–	12.6	
.	–	15.8	
.	87.83	–	
.	86.75	–	Taken from the churn.
.	–	7.6	
.	–	13.5	

Sample 5771 was a pound "print," which was obtained from a Worcester County farmer. On cutting into it, it was found to consist of two distinct grades of butter, — a centre of low grade salt butter, enclosed in high grade fresh butter. Sample c was obtained from a New Hampshire farmer who comes into this State to sell his produce. The specimen proved to be a mixture of pure and artificial butters. A more complete examination gave the following results: —

Fat,	77.24	Decinormal sodic hydrate solution required for neutralizing soluble fat acids from 2.5 Gm. fat = 7.6 c. c.
Water,	12.24	
Salts,	9.84	
Curd,	0.68	

Cheese.

Ten samples of cheese were examined for lard and other foreign substances, and found to be genuine. One sample (7811) was in such a state of decomposition that it was unfit for food.

Condensed Milk.

Eight samples of condensed milk of different brands were received. All show small amounts of fat: —

Inspector's Number.	Fat.	Sugar.	Albuminoids.	Ash.	Solids, not Fat.	Total Solids.	Water.
*6200,	4.42	-	-	-	71.74	76.16	23.84
6202,	6.	-	-	-	73.90	79.90	20.10
*6214,	4.36	-	-	-	71.86	76.22	23.78
6216,	7.38	-	-	-	71.64	79.02	20.98
†7261,	6.10	53.50	11.58	2.16	67.24	73.34	26.66
†7385,	6.42	56.52	9.45	1.05	67.02	73.44	26.56
——,	5.68	60.	4.02	1 62	65.64	71 32	28.68
——,	7.18	-	-	1.64	30.24	37.42	62.58

Lard.

Twenty samples of lard were examined for foreign matter; seven samples proved to contain varying amounts of tallow, which, it is claimed, is added to give firmness to lard destined for export to hot climates. Most of the seven, however, were purchased during the winter season in the retail markets. The remaining thirteen specimens proved to be pure.

* Same brand. † Same brand.

Olive Oil.

ɑety-one samples received, sixty-eight proved to be ı and twenty-three genuine. The former were of fferent brands, as follows: —

:. Ferrari,"	1 sample.
ı. Verona,"	2 samples.
:. L. Dacosini,"	2 "
;erger Frères,"	1 sample.
;uillaume,"	2 samples.
; Loubon,"	27 "
.. Seguin,"	27 "
[uile d'Olive Vierge d'Aix,"	6 "

ll be noticed that the greater part of the spurious n the market is represented by the brands Loubon uin. Several brands, which a short time ago were et with, have almost or entirely disappeared from :ket, while the commonest brands are frequently "compound" or "salad oil."

Vinegar.

ıe hundred and sixteen samples examined, forty-five ɔve and sixty-nine below the standard of 4½ per cent. :id. In no case was any mineral acid detected. The ıf examination were as follows: —

R's Number.	Percentage of Acetic Acid.	Inspector's Number.	Percentage of Acetic Acid.
. . . .	7.08	3400, ...	5.04
. . . .	6.48	3410, ...	5.04
. . . .	6.36	4523, ...	5.04
. . . .	6.30	6094, ...	5.04
. . . .	5.88	7917, ...	4.97
. . . .	5.88	1934, ...	4.92
. . . .	5.66	7915, ...	4.92
. . . .	5.64	2060, ...	4.90
. . . .	5.58	3180, ...	4 88
. . . .	5.52	5876, ...	4.82
. . . .	5.52	1946, ...	4.80
. . . .	5.51	3688, ...	4.80
. . . .	5.44	3776, ...	4.78
. . . .	5.42	3038, ...	4.74
. . . .	5.40	4917, ...	4.68
. . . .	5.32	3418, ...	4.66
. . . .	5.28	3394, ...	4.63
. . . .	5.16	4136, ...	4.62

* "White Wine" vinegar. † Malt vinegar.

REPORT OF THE ANALYST OF FOOD.

BY PROF. EDWARD S. WOOD, M. D.

Alum is the only substance used in the manufacture of baking powders which can be considered deleterious. The small amounts of accidental impurities of commercial cream of tartar which find their way into the tartar baking powders and the accidental impurities of acid phosphate of calcium in the phosphate powders are not deleterious and are very unimportant.

TEA.

But two out of sixty-six samples of tea were condemned. Number 6895 was of very inferior quality, devoid of flavor; Number 7541 was very dirty. In none of the samples were any foreign leaves detected.

The following table gives the percentages of soluble and insoluble ash: —

Inspector's Number.	Soluble Ash.	Insoluble Ash.	Total.	Inspector's Number.	Soluble Ash.	Insoluble Ash.	Total.
5679, . .	3.43	2.12	5.55	6895, . .	2.83	2.89	5.72
5681, . .	3.48	2.76	6.24	6910, . .	–	–	5.25
5683, . .	2.75	3.44	6.19	6967, . .	2.72	3.57	6.29
5685, . .	3.02	2.74	5.76	6969, . .	2.96	3.13	6 09
5687, . .	3.57	2.57	6.14	7101, . .	2.64	3.60	6.24
5895, . .	2.83	2.69	5.52	7359, . .	3.12	3.73	6.85
5897, . .	3.09	3.04	6.13	7361, . .	3.59	2.82	6.31
5965, . .	2.44	3.72	6.16	7371, . .	2.81	2.69	5.50
6028, . .	2.45	2.84	5.29	7373, . .	3.12	3.28	6.40
6038, . .	–	–	6.70	7455, . .	3.42	2.77	6.19
6055, . .	2.86	2 88	5.74	7485, . .	3.11	2.81	5.92
6057, . .	2.99	3.07	6.06	7497, . .	3.06	2.62	5.68
6059, . .	2.19	3.91	6.10	7499, . .	3.	2.95	5.95
6061, . .	2.99	2.95	5.94	7501, . .	3.49	3.09	6.58
6063, . .	2.76	3.16	5.92	7537, . .	3.10	3 17	6.27
6065, . .	–	–	5.67	7539, . .	3.67	2.74	6.41
6067, . .	2.84	2.91	5.75	7541, . .	2.66	5.61	8 27
6069, . .	2.58	3.76	6.34	7609, . .	3.29	2.79	6.08
6157, . .	3.12	2.97	6.09	7611, . .	3.08	4.06	7.14
6159, . .	2.91	3.49	6.40	7703, . .	3.63	2.90	6.53
6255, . .	3.31	2.58	5.89	7705, . .	–	–	6.68
6299, . .	2.84	3.18	6.02	7807, . .	3.11	3.55	6.66
6301, . .	3.61	2.70	6.31	7907, . .	3.36	2.68	6 04
6303, . .	3.60	2.93	6.53	7909, . .	3.03	3.06	6.09
6305, . .	2.82	2.54	5.36	7923, . .	3.13	3.05	6.18
6338, . .	2.86	3.82	6.68	7927, . .	3.05	3.81	6.86
6354, . .	3.34	3.63	6.97	7929, . .	2.87	3.39	6.26
6466, . .	3.86	3.65	7.51	8099, . .	3.09	4.11	7.20
6518, . .	3.37	2.67	6.04	8347, . .	2.14	2.85	5.99
6785, . .	3.36	2.28	5.64	8349, . .	3.19	3.13	6.32
6861, . .	2.67	3.08	5.75	9061, . .	3.73	2.96	6.69
6863, . .	3.12	3.23	6.35				

COCOA AND CHOCOLATE.

Twenty-nine samples of cocoa and chocolate proved, with one exception, to be good. The exception (5907) was a very old chocolate, which was quite wormy.

COFFEE.

I received thirty-one samples of coffee, twenty-two of which were what are known as "package" coffees. The nine other samples were pure. The greater number of the "package" coffees do not purport to be the genuine article, for, though not directly stated on the label, the character of the contents is implied in the "Directions for Use," which generally begin with the words: "Use one-third less than you would of pure coffee." Only two or three of them contained any real coffee, the compound usually consisting of roasted peas, rye, or wheat, with or without chiccory.

The following brands were represented: —

Eureka.	Brazil Blended.
Newhall's.	Chase's.
Medicated.	Bacon, Stickney & Co.
Plantation.	Spurr's Breakfast.
Old Spanish Hacienda.	American Company's Java Coffee.
French Breakfast.	Excelsior.
Vienna Breakfast.	

SUGAR.

Fifty-four samples of sugar, including granulated, powdered and brown sugars, were examined and found to be genuine. The highest percentage of invert sugar found in a brown sugar was 17.40. Two samples of granulated sugar were found to contain considerable ultramarine, and were condemned.

MAPLE SUGAR AND MAPLE SYRUP.

Of twelve samples examined, five proved to be adulterated and seven genuine. The adulterants were molasses and glucose syrup. One specimen was almost wholly common molasses.

Molasses.

I received forty-one samples of molasses, of which twelve proved to be adulterated, as described below, and twenty-nine genuine. The highest percentage of invert sugar was 32.26.

Twelve samples proved to have been bleached with chloride of tin, which, when added in solution to low-grade molasses, unites with the coloring matter to form an insoluble compound, which is precipitated, and a lighter colored molasses, of apparently higher grade, is the result. As the salts of tin are all poisonous, the practice is doubly reprehensible. The adulteration is usually carried out in the original package, so that the compound which is formed is not removed, but is found in greatest abundance in the sediment, which is very generally purchased of the retailer by manufacturers of cheap candies. The practice appears to be a new one in this part of the country, and, it is to be hoped, will prove short-lived. Complaints which have been entered in the courts against two of the largest dealers will doubtless serve to render the admixture unpopular and unprofitable.

Twenty-four samples were examined with special reference to the presence of tin, and twelve were found to contain it.

Honey.

Of thirty-seven samples of strained and comb honey, nineteen were genuine and eighteen adulterated. The adulterants found were glucose and common syrup. Most of the adulterated samples purport to be "Pure White Clover Honey;" many of them consist of a small piece of honey in the comb, surrounded by a tumbler of glucose or sugar syrup.

Jellies and Jams.

Three samples of genuine and twenty-nine of adulterated jellies and jams were submitted for examination. The adulterated samples were all of very cheap grade and were made of apple pulp, colored and flavored. The fruits represented were quince, crabapple, peach, pineapple, blackberry, strawberry, raspberry, grape, orange, lemon and currant. In no case did the flavor suggest the fruit.

Candies.

Eighty-seven specimens of candies of various kinds were examined for terra alba and poisonous colors. Sixty-four were found to contain no injurious ingredient. Eleven samples of lozenges were contained in wrappers containing arsenical colors; the lozenges themselves were good.

One specimen (No. 7593) was wrapped in paper containing a very large amount of arsenic; some of the pigment adhered to the candy, which, when subjected to analysis, yielded a trace of arsenic.

Numbers 6985, 7173, 7175 and 7453 were of yellow sugars used for decorating cake and other sweetmeats. The coloring matter in each case was chromate of lead.

Number 3921 was a green sugar, or rather a mixture of sugar colored blue with indigo and another colored yellow with chromate of potassium.

Number 3919 was a yellow sugar, colored with chromate of potassium. The amount present was equal to 0.52 per cent. by weight.

Numbers 5784, 6719, 6885, 6973 and 7177 were yellow "candy beans," colored with chromate of potassium. Numbers 6885 and 7177 were of such size that about sixty would make an ounce. The amount of poison per piece was 1.16 and 0.63 milligrams respectively.

Pickles.

Seven samples of pickles were found to contain nothing injurious and to be of good quality.

Mustard.

In the purchase of mustard and other articles of food bearing on the package the name of the manufacturer, it is natural that the inspectors refrain from buying, except occasionally, the brands which experience has shown to be genuine. It is by reason of this discrimination that of two hundred and eleven samples of mustard, the very large proportion of one hundred and twenty-four proved to be adulterated. Most of the eighty-seven genuine samples were purchased in bulk. The adulterant was in most cases wheat or rice flour.

The brands represented by the one hundred and twenty-four adulterated samples include the following: —

Colburn's Mustard.	Crescent Mills, Conn.
Colman's Mustard.	Spurr's Mustard.
J. B. Anthony, Troy.	Blackwell & Co., 40 Oxford St.
India Mills, N. Y.	Mather Bros., Albany.
London Mustard.	Boston Mills.
Bacon & Stickney, N. Y.	Durham Mustard.
Cole & Firth.	Union Spice Co., N. Y.
Imperial.	English Mustard.
Springfield Coffee and Spice Co.	Empire Mills.
Knickerbocker Mills, N. Y.	India Mills.
Matthews, Underhill & Co., N. Y.	Quinnipiac Mills, Conn.
Austin & Rich, N. Y.	Tiger Mills, N. Y.
Durkee's Mustard, N. Y.	Curlew & Sons.

With the exception of three, all of the above are from outside the State. The mustard put up by home dealers is, as a rule, of good quality.

GINGER.

Eight samples out of fifty-eight delivered proved to be adulterated. The adulterants were wheat flour and corn meal.

WHITE PEPPER.

One hundred and twenty-eight samples; sixty-five good and sixty-three adulterated. The commonest adulterants were buckwheat, rice and wheat. The amount of admixture varied from 5 to 50 per cent. Among the samples marked with the manufacturer's name, which proved to be considerably adulterated, were the following brands: —

Wilson, Pratt & Co., N. Y.	Union Spice Co., N. Y.
Augur, Tuttle & Co., Conn.	Springfield Coffee and Spice Co.
E. Howard.	

BLACK PEPPER.

Seventy-one samples; thirty good, forty-one adulterated. The adulterants were the same as with white pepper. The following brands were among the adulterated samples: —

Sand's, Hartford, Conn.	Springfield Coffee and Spice Co.
Quinnipiac Mills, Conn.	Crescent Mills, Conn.
Union Spice Co., N. Y.	

MACE.

Forty-five samples received; sixteen good and twenty-nine adulterated. The commonest adulterants were corn, wheat and buckwheat. Two specimens were nearly 75 per cent. wheat. The adulterated brands included the following:

F. H. Leggett, N. Y.
Knickerbocker Mills, N. Y.
Taylor & Staley, Troy.
S. R. Van Duzer, N. Y.
Springfield Coffee and Spice Co.
Bennett & Sloan, N. Y.
Bacon & Stickney, N. Y.

CASSIA.

I received twenty-four samples of cassia and cinnamon, of which seventeen proved to be pure, and seven adulterated with the usual substitutes.

CLOVES.

Of thirty-four samples of ground cloves, nine were condemned as adulterated, on account of added substances, of too great proportion of stems, or of a lack of the essential oil.

PIMENTO.

Six samples were received; with one exception they were genuine.

CAYENNE.

Of four samples received, but one (No. 6346, Union Spice Co., N. Y.) was adulterated.

CURRY POWDER.

Eight samples of curry were examined and proved to be genuine. Two specimens contained rather more than the usual amount of ginger, but this can hardly be construed as an adulteration.

HORSERADISH.

Of nine samples of horseradish, one was genuine and eight appeared to be the usual mixture with turnip.

CANNED FOODS.

Fourteen samples were examined, — one of pineapple, two each of tomatoes and beans, and nine of peas. With one exception, they were quite free from metallic contamination. One specimen of beans contained a very small trace of lead, doubtless from the solder. The danger from this class of foods appears, in the light of recent investigations, to have been very much overestimated.

Isinglass and Gelatine.

Four samples of the former and fifteen of the latter proved to be gelatine of very good quality. It appears to be a common belief among dealers that the two terms are synonymous.

Maccaroni and Vermicelli.

Eight samples of yellow maccaroni and vermicelli were examined for poisonous coloring matter, and all were found to be free.

Arrowroot.

Eighteen samples of West India arrowroot were received; fourteen proved to be pure and four adulterated. Two samples were about equal parts of arrowroot and corn starch; one sample contained about 75 per cent. of corn; the fourth consisted almost wholly of corn starch, the genuine arrowroot present not exceeding 5 per cent.

Bread.

Three loaves of bread were examined for alum and copper, which were absent in every case. The amount of water present was somewhat excessive; the percentages were, respectively, 39.54, 42.89 and 43.50. The percentages of ash were 1.19, 0.44 and 0.59.

Miscellaneous.

1. *Buckwheat.* Two samples; both genuine.
2. *Tapioca.* One sample; genuine.
3. *Cerealine.* One sample; proved to be made of corn, as represented.
4. *Cracked Oats.* One sample; genuine.
5. *Sage.* Two samples; both genuine.
6. *Poultry Dressing.* One sample; genuine.
7. *Desiccated Cocoanut.* One sample; genuine.
8. *Citron.* One sample, alleged to have been colored with copper, was found to be genuine.
9. *Table Salt.* One sample; proved to be of very poor quality.

Respectfully,

EDWARD S. WOOD, M. D.

REPORTS OF THE ANALYSTS OF MILK.

REPORTS OF THE ANALYSTS OF MILK.

BOSTON, MASS., June 1, 1886.

Dr. S. W. ABBOTT, *Health Officer,*
13 Beacon Street, Boston.

DEAR SIR: — I have the honor to submit my report as Milk Analyst for Eastern Massachusetts for the fourteen months ending May 31, 1886.

Respectfully,
CHARLES HARRINGTON, M. D.

DR. HARRINGTON'S REPORT.

During the fourteen months since my last annual report I have received two thousand and twenty-four (2,024) samples of milk. As in former years, there have been many samples which were plainly above the standard, and a number of these have been passed as good without analysis. Including these samples, 56.22 per cent. of all received (1,144 out of 2,024) were above the standard of 13 per cent. solids.

The sources of the specimens received are as follows: —

(1.) Shops (Class A), and } In twenty (20) cities and thirty
(2.) Wagons (Class B), } (30) towns.
(3.) Producers suspected of adulterating (Class C).
(4.) Unknown, — from private individuals and public institutions (Class D).
(5.) Known purity, — from cows of public institutions and private farms, milked in the presence of the inspectors (Class E).

he results obtained by analysis are given below: —

Boston.

	Class A.	Class B.	Total.
Samples received, ...	54	64	118
Passed on inspection, ...	2	2	4
Samples analyzed, ...	52	62	114
Above the standard (inc. samples passed),	25	34	59
Below the standard, ...	29	30	59

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5720, ...	6.92	9.54	16.46	83.54
2704, ...	5.85	9.85	15.70	84.30
5888, ...	5.54	9.66	15.20	84.80
6408, ...	4.72	10.00	14.72	85.28
7619, ...	5.06	9.43	14.49	85.51
5726, ...	4.13	9.87	14.00	86.00
6412, ...	3.94	9.95	13.89	86.11
5734, ...	3.99	9.89	13.88	86.12
5782, ...	4.08	9.71	13.79	86.21
5774, ...	3.94	9.83	13.77	86.23
5776, ...	3.96	9.79	13.75	86.25
6416, ...	3.50	10.17	13.67	86.3
2554, ...	2.96	10.63	13.59	86.4
5722, ...	3.71	9.79	13.50	86.
7613, ...	3.80	9.61	13.41	86.
6406, ...	3.54	9.84	13.38	86
7621, ...	3.38	9.47	13.35	8
5772, ...	3.62	9.72	13.34	8
5724, ...	3.22	10.07	13.29	
6410, ...	2.92	10.22	13.14	
7617, ...	3.38	9.75	13.13	
6418, ...	3.82	9.29	13.11	
5764, ...	3.26	9.75	13.01	
6402, ...	3.42	9.47	12.89	
5780, ...	3.33	9.51	12.84	
4811, ...	3.47	9.20	12.67	
5728, ...	3.11	9.46	12.57	
4805, ...	3.36	9.17	12.53	

Class A — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6404, ...	2.56	9 95	12.51	87.49
6414, ...	2.31	9.11	12.42	87.58
5778, –	2 99	9.36	12.35	87.65
2702, –	2.74	9 58	12 32	87.68
5770, –	3.01	9 28	12.29	87.71
5776, –	2.58	9 51	12.09	87.91
5768, –	2 49	9.55	12.04	87 96
– –	2.15	9.79	11.94	88.06
5876, –	2 20	9.69	11.89	88.11
5882, –	2 58	9.13	11.71	88 29
2708, –	2 45	9.06	11.51	88.49
2706, –	1.76	9.74	11 50	88.50
5732, –	2 41	9 08	11.49	88.51
5730, –	1.81	9.61	11.42	88.58
5880, –	1.43	9.75	11.18	88.82
4807, –	2.08	8.90	10.98	89.02
5884, –	2 97	7.99	10.96	89.04
2588, –	1.30	9.56	10 86	89.14
5878, –	1.93	9.52	10.45	89.55
5886, –	2.12	7.88	10.00	90.00
2568, –	1.80	7.62	9.42	90.58
2700, –	1.47	7.33	8 80	91.20
2586, –	2.	6.58	8.58	91.42
4803, –	0.34	7.81	8 15	91.85

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
2638, . –	15.24	9 30	24.54	75.46
2578, . –	15.05	8.67	23.72	76.28
2538, . –	12.52	10.13	22.65	77.35
2532, . –	11.18	9.55	20.73	79.27
2504, . –	11.97	7.73	19.70	80.30
2640, . –	10.08	8.81	18.89	81.11
2634, . –	9.15	9.69	18 84	81.16
2520, . –	7.66	9.67	17.33	82.67
2500, . –	6.26	9.69	15.95	84.05
2480, . –	5.92	9.84	15.76	84.24

Class B — Continued.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
2582, ...	4.40	10.94	15.34	84.66
2530, ...	6.14	9.05	15.19	84.81
2574, ...	5.35	9.75	15.10	84.90
2514, ...	5 12	9.67	14.79	85.21
2558, ...	4.58	10.07	14.65	85.35
2502, ...	6 00	8.59	14.59	85.41
2522, ...	3.86	9.72	14.58	85.42
2570, ...	4 54	10.00	14.54	85.46
2580, ...	5.41	9.10	14 51	85.49
5717, ...	4.07	10 38	14.45	85.55
2496, ...	4.46	9.70	14.16	85.84
2544, ...	3.51	10 38	13.89	86.11
2560, ...	3.28	10.27	13.55	86 45
2512, ...	3.85	9.67	13.52	86 48
2542, ...	2.73	10 79	13.52	86.48
2556, ...	3.69	9.69	13.38	86.62
7201, ...	3.10	10.27	13.37	86.63
2492, ...	3.54	9.73	13.27	86.73
2488, ...	3.29	9 98	13.27	86.73
7615, ...	3.59	9.65	13.24	86.76
2636, ...	3.49	9.59	13.08	86 92
7627, ...	3.53	9.50	13.03	86.97
4799, ...	3.20	9.74	12.94	87.06
2486, ...	3 06	9.86	12.92	87.08
2534, ...	3.26	9.63	12.89	87.11
5713, ...	2.43	10.43	12 86	87.14
2484, ...	3 16	9.69	12.85	87.15
2510, ...	4.02	9 82	12.84	87 16
2498, ...	3.77	9.04	12.81	87.19
2630, ...	3.32	9.29	12.61	87.39
4813, ...	2 95	9.74	12.69	87 31
2506, ...	3.33	9.20	12.53	87.47
2494, ...	3.37	9 12	12.49	87.51
2632, ...	3.37	9 03	12.40	87.60
5715, ...	2.04	10.36	12.40	87.60
2516, ...	2.76	9 59	12.35	87.65
6319, ...	2.86	9.46	12.32	87.68

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5890, ...	3.01	9.28	12.29	87.71
2490, ...	2.82	9.45	12.27	87.73
2536, ...	2.48	9.77	12.25	87.75
2518, ...	3.52	8.57	12.09	87.91
2566, ...	2.30	9.71	12.01	87.99
2482, ...	2.83	9 17	12.00	88.00
8463, ...	3.09	8.87	11.96	88.04
2572, ...	1.26	10.68	11.94	88.06
2478, ...	2.76	8.81	11.57	88.43
2584, ...	2.25	8.73	10.98	89.02
2508, ...	2.11	8.82	10.93	89.07
2576, ...	2.55	8.23	10.78	89.22
2540, ...	1.94	8.56	10.50	89.50
2642, ...	1.80	8.44	10.24	89.76
2564, ...	1.78	7.82	9.60	90.40

Lowell.

	Class A.	Class B.	Total.
Samples received, ...	46	143	189
Passed on inspection, ...	11	53	64
Samples analyzed, ...	35	90	125
Above the standard (inc. samples passed),	16	92	108
Below the standard, ...	30	51	81

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6666, ...	3.16	10.29	13.45	86.55
6296, ...	3.20	10.16	13 36	86.64
4896, ...	3.86	9.37	13.23	86.77
4890, ...	5.12	7.98	13.10	86.90
4892, ...	4.05	9.01	13.06	86.94
4914, ...	3 45	9.53	12.98	87.02
4660, ...	2 54	10.23	12.77	87.23
4662, ...	2.10	10.52	12.62	87 38
4368, ...	2.92	9.62	12.54	87.46

Class A — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6492, ...	2.81	9.65	12.46	87.54
4664, ...	2.79	9.54	12.33	87.67
6816, ...	3.26	9.01	12.27	87.73
4912, ...	3.49	9.69	12.18	87.82
4910, ...	3.67	9.45	12.12	87.88
3282, ...	2.00	10.04	12.04	87.96
4374, ...	2.31	9.64	11.95	88.05
6820, ...	2.40	9.52	11.92	88.08
6818, ...	3.02	8.82	11.84	88.16
2750, ...	3.31	8.43	11.74	88.26
4390, ...	1.21	10.16	11.37	88.63
2748, ...	2.60	8.76	11.36	88.64
6814, ...	1.82	9.52	11.34	88.66
4394, ...	2.19	9.14	11.33	88.67
4392, ...	2.50	8.66	11.16	88.84
8380, ...	1.32	9.84	11.16	88.84
7000, ...	2.58	8.44	11.02	88.98
6486, ...	2.63	8.35	10.98	89.02
3486, ...	2.17	8.71	10.88	89.12
6656, ...	2.95	7.81	10.76	89.24
4386, ...	2.71	7.80	10.51	89.49
6490, ...	2.64	7.84	10.48	89.52
3276, ...	2.77	7.61	10.38	89.62
4384, ...	1.14	8.99	10.13	89.87
4366, ...	1.24	8.28	9.52	90.48
4376, ...	1.89	7.53	9.42	90.58

Class B.

6244, ...	19.04	9.05	28.09	71.91
6246, ...	16.40	9.26	25.66	74.34
6240, ...	4.94	9.60	14.54	85.46
4934, ...	4.70	9.77	14.47	85.53
4900, ...	4.03	10.14	14.17	85.83
4916, ...	4.18	9.95	14.13	85.87
4920, ...	4.74	9.29	14.03	85.97
4936, ...	3.89	10.12	14.01	85.99

Class B — Continued.

INSPECTOR'S NUMBER.	Fat.	Solids, not Fat.	Total Solids.	Water.
. . . . . .	3.54	10.45	13.99	86.01
. . . . . .	4.08	9.90	13.98	86.02
. . . . . .	3.61	10.35	13.96	86.04
. . . . . .	3.97	9.88	13.85	86.15
. . . . . .	3.76	10.01	13 77	86 23
. . . . . .	3.68	10.02	13.70	86.30
. . . . . .	3.59	10.07	13.66	86.34
. . . . . .	3.65	9.95	13 60	86.40
. . . . . .	3.50	10.10	13.60	86.40
. . . . . .	3.60	9.99	13.59	86.41
. . . . . .	3.53	10.03	13.56	86.44
. . . . . .	3 62	9.93	13.55	86.45
. . . . . .	3.66	9.88	13.54	86.46
. . . . . .	3.82	9.70	13.52	86.48
. . . . . .	3.85	9.64	13.49	86.51
. . . . . .	3.84	9.65	13.49	86.51
. . . . . .	3.91	9.56	13.47	86.53
. . . . . .	3.64	9.81	13.45	86.55
. . . . . .	3.30	10.06	13.36	86.64
. . . . . .	3.92	9.41	13.33	86.67
. . . . . .	3.48	9.78	13.26	86.74
. . . . . .	3.77	9.46	13.23	86.77
. . . . . .	3.55	9.68	13.23	86.77
. . . . . .	3.79	9.39	13.18	86.82
. . . . . .	3.77	9.40	13.17	86.83
. . . . . .	3.19	9.97	13.16	86.84
. . . . . .	3.59	9.53	13.12	86.88
. . . . . .	3 58	9.49	13.07	86.93
. . . . . .	3.28	9.79	13.07	86.93
. . . . . .	3.50	9.54	13.04	86.96
. . . . . .	3.43	9 60	13.03	86.97
. . . . . .	3.42	9.57	12.99	87.01
. . . . . .	3.05	9.93	12.98	87.02
. . . . . .	3.52	9 43	12.95	87.05
. . . . . .	3.09	9.86	12.95	87.05
. . . . . .	3.58	9.36	12 94	87.06
. . . . . .	3 07	9.81	12.88	87.12

Class B — Continued.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4254, ...	3.13	9.66	12.79	87 21
6658, ...	3.03	9.76	12.79	87.21
7082, ...	3.21	9.57	12.78	87.22
4256, ...	3.08	9.70	12.78	87.22
6654, ...	2 92	9.85	12.77	87.23
4294, ...	3.63	9.13	12.76	87.24
3336, ...	3.09	9.64	12.73	87.27
2740, ...	3.04	9.69	12.73	87.27
7086, ...	3.40	9.32	12.72	87 28
6288, ...	3.44	9.25	12.69	87.31
4888, ...	3.53	9.15	12.68	87.32
3338, ...	3.13	9.53	12.66	87.34
4284, ...	3.13	9.52	12.65	87.35
4282, ...	3.14	9 48	12.62	87.38
4906, ...	3 60	9.00	12.60	87.40
2744, ...	2.88	9.72	12 60	87.40
6290, ...	3 39	9.14	12.53	87.47
4272, ...	3.14	9.38	12.52	87.48
4292, ...	2.86	9 65	12.51	87.49
2738, ...	3.36	9.13	12.49	87.51
6822, ...	2 93	9.56	12.49	87.51
3324, ...	2.67	9.78	12 45	87.55
3866, ...	3.22	9.17	12 39	87.61
4262, ...	3.22	9.16	12.38	87.62
4370, ...	2.81	9.57	12.38	87.62
3334, ...	2.74	9.60	12.34	87.66
7078, ...	3.27	9.06	12.33	87.67
3900, ...	2.66	9.63	12.29	87.71
4248, ...	2.90	9.23	12.13	87.87
6242, ...	2.97	9.12	12.09	87.91
6332, ...	3.23	8.81	12.04	87.96
7084, ...	2.70	9.28	11.98	88.02
4268, ...	2.92	9.03	11.95	88.05
3848, ...	2 62	9.30	11.92	88.08
3882, ...	2.72	9.19	11.91	88.09
4378, ...	2.70	9.01	11.71	88.29
4898, ...	2.94	8.69	11.63	88.37

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3274,	2.02	9.61	11.63	88.37
3272,	2.76	8.86	11.62	88.38
4938,	2.19	9.40	11.59	88.41
3318,	2.41	9.13	11.54	88.46
3330,	2.70	8.75	11.45	88.55
4274,	2.64	8.54	11.18	88.82
4924,	0.86	10.07	10.93	89.07
4276,*	1.15	9.38	10.53	89.47

* Sold as "skimmed."

Fall River.

	Class A.	Class B.	Total.
Samples received,	15	110	125
Passed on inspection,	4	32	36
Samples analyzed,	11	78	89
Above the standard (inc. samples passed),	8	83	91
Below the standard,	7	27	34

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5534,	3.72	10.01	13.73	86.27
5546,	3.60	10.03	13.63	86.37
6095,	3.27	9.88	13.15	86.85
6874,	3.62	9.44	13.06	86.94
5818,	2.85	9.21	12.06	87.94
4839,	2.07	9.48	11.55	88.45
6876,	2.52	8.98	11.50	88.50
6375,	3.01	7.91	10.92	89.08
4841,	2.19	8.30	10.49	89.51
7091,	2.86	7.31	10.17	89.83
7089,	2.55	6.46	9.01	90.99

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6933,	6.20	9.56	15.76	84.24
5528,	5.77	9.75	15.52	84.48
5816,	4.74	10.59	15.33	84 67
5524,	4.06	10.94	15.00	85.00
6929,	4.54	10.19	14.73	85.27
5520,	4.34	10.21	14 55	85 45
5822,	3.87	10 52	14.39	85 61
5538,	3.79	10.51	14.30	85.70
6911,	4.17	10 10	14.27	85.73
7085,	4.14	10.13	14.27	85.73
5526,	4.29	9.88	14.17	85.83
6081,	3.59	10.45	14.04	85.96
6923,	4 39	9.64	14.03	85.97
6921,	3.77	10.24	14.01	85.99
6097,	4.15	9.79	13.94	86 06
8579,	3.58	10.32	13.90	86.10
7077,	3.49	10.37	13.86	86.14
6093,	4.20	9.63	13.83	86.17
5820,	3.74	10 05	13.79	86 21
6925,	4.19	9 58	13.77	86.23
6907,	3 63	10.12	13.75	86.25
5814,	3.25	10.46	13.71	86.29
6903,	3.72	9.96	13.68	86.32
6917,	3.43	10.25	13.68	86.32
5810,	3.30	10.36	13.66	86.34
6909,	3.64	10.01	13.65	86 35
4145,	4 21	9.43	13.64	86.36
5530,	3.64	9.97	13.61	86.39
5532,	3.51	10.10	13.61	86.39
6073,	3.29	10.28	13.57	86.43
6931,	4.14	9.34	13.48	86.52
5544,	3.49	9.99	13.48	86.52
6866,	3.87	9.60	13.47	86.53
6905,	3.86	9.59	13.45	86.55
5812,	3.30	10.09	13.39	86.61
8571,	3.28	10.11	13 39	86.61
8601,	3.48	9.90	13.38	86.62

Class B — Continued.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6395, ...	3 58	9.80	13.38	86.62
5522, ...	3.40	9.94	13.34	86.66
5542, ...	3.08	10.23	13.31	86.69
6389, ...	3.07	10.23	13.30	86.70
6913, ...	3.28	9.99	13.27	86.73
7081, ...	2.33	10.91	13 24	86.76
6915, ...	3.21	10.02	13.23	86.77
5536, ...	4.00	9.22	13.22	86.78
8575, ...	3.53	9 68	13.21	86.79
6071, ...	3.10	10.08	13.18	86.82
4159, ...	3.46	9.66	13.12	86.88
6085, ...	3.59	9.51	13.10	86.90
6075, ...	2.91	10.18	13 09	86.91
6870, ...	3.48	9.56	13.04	86 96
6101, ...	3.02	9.96	12 98	87.02
6383, ...	3.50	9.46	12.96	87.04
8583, ...	3.38	9 57	12.95	87.05
4147, ...	3.77	9.12	12.89	87.11
6872, ...	3.25	9.45	12.70	87.30
6868, ...	2.83	9.86	12.69	87.31
7087, ...	3.04	9.63	12.67	87.33
4139, ...	3.57	9.09	12.66	87.34
6369, ...	3.49	9.13	12.62	87.38
6919, ...	3.26	9.35	12.61	87.39
4151, ...	3.46	9.09	12.55	87.45
6880, ...	3.52	9.00	12 52	87.48
7079, ...	3.04	9.30	12.34	87.66
6377, ...	2.98	9.32	12.30	87.70
5824, ...	2.73	9.57	12.30	87.70
4157, ...	2.28	9.79	12.07	87.93
6091, ...	2.20	9.83	12.03	87.97
5540, ...	2.99	9.03	12.02	87.98
6083, ...	3.09	8.88	11.97	88.03
4149, ...	3.03	8.83	11.86	88.14
4843, ...	2.58	9.23	11.81	88.19
6381, ...	3.24	8.55	11.79	88.21
4155, ...	2.51	9.16	11.67	88.33

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.
6927, ...	2.72	8.72	11.44
6363, ...	3.12	7.83	10.95
7083, ...	2.68	7.42	10.10
8573, ...	2.15	7 41	9.56

Cambridge.

	Class A.	Class B.
Samples received, ...	69	49
Passed on inspection, ...	23	13
Samples analyzed, ...	46	36
Above the standard (inc. samples passed),	28	22
Below the standard, ...	41	27

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.
7263, ...	7.62	8.26	15.88
6235, ...	3.34	10.34	13 68
5707, ...	3.53	9.87	13.40
3197, ...	4.83	8.54	13.37
8139, ...	1.62	11.59	14 21
6241, ...	2.96	9.80	12 76
3199, ...	3.84	9.40	12.74
8455, ...	2.88	9.83	12.71
7267, ...	3.33	9.19	12.52
8447, ...	3.24	9.25	12.49
3187, ...	2.52	9.95	12.47
3195, ...	3.36	9.10	12.46
6311, ...	2.58	9.86	12.44
8271, ...	3 19	9.22	12.41
7265, ...	3.43	8.93	12 36
8141, ...	2.85	9.41	12 26
5756, ...	2.59	9.65	12.24
8289, ...	2.43	9.78	12.21
6309, ...	1.28	10.83	12.11
8131, ...	2.58	9.35	11.93

Class A — Concluded.

INSPECTOR'S NUMBER.	Fat.	Solids, not Fat.	Total Solids.	Wate
	2.63	9.27	11.90	88.10
	2.47	9.37	11.84	88.16
	2.41	9.35	11.76	88.24
l,	3.93	7.74	11.67	88.33
il,	2.46	9 17	11.63	88 37
69,	2.96	8 58	11.54	88.46
143,	2.48	9.06	11.54	88.46
133.	2.03	9.51	11.54	88.46
697,	2.08	9.31	11.39	88.61
137,	2.69	8.68	11.37	88.63
579,	2.24	9.13	11.37	88.63
277,	3.76	7.50	11.26	88.74
273,	1.74	9.50	11.24	88.76
117,	2.48	8.63	11.11	88.89
89,	2.49	8.58	11.07	88.93
45,	2.54	8.44	10.98	89.02
19,	2.74	8.22	10.96	89.04
1,	2.12	8.73	10 85	89.15
1,	2.08	8.75	10.83	89.17
,	2.13	8 69	10 82	89.18
,	2.51	8.10	10.61	89.39
	2.04	8.51	10.55	89.45
	1.57	8.98	10 55	89.45
	1.50	8.76	10 26	89 74
	2.65	7.15	9.80	90 20

Class B.

	4.81	10.81	15.62	84.38
	4.84	10.09	14.93	85.07
	3.64	10.16	13.80	86 20
	3.79	9 88	13 67	86.33
	2.64	10.02	13.66	86.34
	3.62	9.89	13.51	86.49
	3.80	9.64	13.44	86.56
	2.88	9.35	13.23	86.77
	3.25	9.88	13.13	86.87

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water
749,	3.48	9.46	12.94	87.06
5233,	2.68	10.12	12.80	87.20
9149,	3.19	9.39	12.58	87.42
5699,	3.73	8.76	12.49	87.51
5760,	3.07	9.42	12.49	87.51
7751,	3.04	9.42	12.46	87.54
9145,	3.13	9.32	12.45	87.55
5705,	3.39	9.03	12.42	87.58
9141,	2.86	9.47	12.33	87.67
5693,	2.99	9.32	12.31	87.69
5500,	2.89	9.37	12.26	87.74
7739,	3.42	8.77	12.19	87.81
5691,	2.89	9.27	12.16	87.84
5501,	3.35	8.79	12.14	87.8[illegible]
6237,	2.75	9.25	12.00	88.[illegible]
5505,	2.27	9.66	11.93	88.[illegible]
8291,	2.88	8.94	11.82	88[illegible]
5575,	3.06	8.75	11.81	88[illegible]
5504,	2.66	9.11	11.77	8[illegible]
6231,	2.28	9.48	11.76	8[illegible]
9151,	2.78	8.95	11.73	8[illegible]
9143,	1.85	9.37	11.22	8[illegible]
5503,	2.37	8.62	10.99	8[illegible]
5689,	3.12	7.76	10.88	[illegible]
8293,	2.42	8.20	10.62	
5703,	1.09	9.01	10.10	
8295,	1.79	7.25	9.04	

Salem.

	Class A.	Class [illegible]
Samples received,	10	77
Passed on inspection,	4	10
Samples analyzed,	6	67
Above the standard (inc. samples passed),	4	4[illegible]
Below the standard,	6	3[illegible]

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
. . . .	1.61	10.44	12.05	87.95
. . . .	1.58	9.69	11.27	88.73
. . . .	2.62	8.30	10.92	89.08
. . . .	0.55	9.56	10.11	89.89
. . . .	1.29	8.70	9.99	90.01
. . . .	0 75	8.53	9.28	90.72

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
. . . .	5.22	10.01	15.23	84.77
. . . .	4.10	9.45	14 55	85.45
. . . . . .	5.09	9.44	14.53	85.47
. . . .	4.50	9.97	14.47	85.53
. . . .	4.38	9.91	14.29	85.71
. . . .	4.24	9.97	14.21	85.79
. . . .	3.50	10.66	14.16	85.84
. . . .	3.51	10.56	14.07	85 93
. . . .	3.77	10.23	14.00	86.00
. . . .	4.14	9.79	13.93	86 07
. . . . .	3.97	9.88	13.85	86 15
. . . .	4.30	9.55	13.85	86.15
. . . .	3.95	9.89	13.84	86.16
. . . .	3.74	10.06	13.80	86 20
. . . .	3.81	9.96	13 77	86 23
. . . . .	3.81	9.80	13.61	86.39
. . . .	3.79	9.79	13.58	86 42
. . . .	3.69	9.87	13 56	86.44
. . . .	3.79	9.76	13 55	86.45
. . . .	4.57	8.96	13.53	86.47
. . . . .	3.78	9.74	13.52	86.48
. . . .	3.83	9.62	13.45	86.55
. . . .	3.51	9.91	13.42	86.58
. . . .	3.36	10.05	13.41	86.59
. . . .	3.20	10 20	13.40	36 60
. . . .	3.63	9.71	13 34	86.66
. . . .	3 65	9.67	13.32	86 68
. . . .	3.92	9.38	13 30	86.70
. . . .	3.47	9.80	13.27	86.73

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3934,	3.29	9.98	13.27	86.73
2764,	3.18	10.03	13.21	86.79
6112,	3.36	9.79	13.15	86.85
6102,	3.91	9.23	13.14	86.86
6306,	3.78	9.32	13.10	86.90
2986,	3.28	9.81	13.09	86.91
2792,	2.60	10.33	12.93	87.07
6104,	3.51	9.36	12.87	87.13
6106,	3.33	9.54	12.87	87.13
3928,	3.09	9.78	12.87	87.13
2996,	2.77	10.09	12.86	87.14
2762,	3.23	9.52	12.75	87 25
2794,	1.22	11.38	12.60	87.40
2804,	2.62	9.97	12.59	87.41
3000,	2.79	9.79	12.58	87.42
2806,	2.44	10.09	12.53	87.47
2798,	2.59	9.92	12 51	87.49
3002,	3.10	9.36	12.46	87.54
6760,	3.38	8.95	12.33	87 67
6100,	2 76	9.56	12.32	87 68
6130,	2.89	9.41	12.30	87.70
6316,	3.68	8.50	12.18	87.82
2796,	2.56	9.54	12.10	87 90
6128,	3.09	8.90	11.99	88 01
6770,	2.90	8.99	11.89	88.11
6772,	2.73	9.05	11.78	88.22
6766,	3.21	8.56	11.77	88.23
6764,	3.01	8.69	11.70	88.30
6762,	3.09	8.58	11.67	88.33
2788,	2.53	9 05	11.58	88.42
6114,	2.83	8.60	11.43	88.57
2754,	2.46	8.92	11.38	88.62
6110,	2.91	8.40	11.31	88.69
6118,	2.49	8.78	11.27	88.73
6126,	2.60	8.41	11.01	88.99
6116,	2.24	8.67	10.91	89.09
2766,	2.49	8.18	10.67	89.33
2790,	2.47	7.86	10.33	89.67

Lawrence.

	Class A.	Class B.	Total.
Samples received, ...	5	81	86
Passed on inspection, ...	–	19	19
Samples analyzed, ...	5	62	67
Above the standard (inc. samples passed), .	3	45	48
Below the standard, ...	2	36	38

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5672, ...	3.89	9.73	13.62	86.38
6454, ...	3.34	9.89	13.23	86.77
6512, ...	2.82	10 25	13.07	86.93
2892, ...	3.49	9.10	12.59	87.41
6514, ...	2.73	9.62	12.35	87.65

Class B.

662, ...	4 62	10.01	14.63	85.37
462, ...	4.21	10.19	14.40	85.60
866, ...	3.54	10.70	14.24	85.76
510, ...	3.88	9.97	13.85	86.15
678, ...	3.79	10.06	13.85	86.15
378, ...	3.72	10.12	13.84	86.16
152, ...	3.58	10.23	13.81	86.19
84, ...	3.45	10.33	13.78	86.22
64, ...	3.63	10.07	13.70	86.30
58, ...	3.34	10.36	13.70	86.30
66, ...	3.81	9.73	13.54	86.46
08, ...	3.36	10 08	13.44	86.56
71, ...	4.03	9.36	13.39	86.61
0, ...	3 84	9.52	13.36	86.64
4, ...	3.14	10.22	13.36	86.64
9, ...	3.82	9.47	13.29	86.71
0, ...	3.53	9.76	13.29	86.71
2, ...	3.48	9.81	13.29	86.71
2, ...	3.74	9.47	13.21	86.79
6, ...	3.12	10.09	13.21	86.79
4, ...	3.43	9.73	13.16	86.84

Class B — Continued.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3742, ...	3.16	9.95	13.11	86.89
5676, ...	3.06	10.05	13.11	86.89
5674, ...	3.48	9 62	13.10	86.90
5668, ...	3.03	10.03	13.06	86.94
6458, ...	3.64	9.36	13.00	87.00
3736, ...	3.19	9.80	12.99	87.01
6506, ...	3.05	9.91	12.96	87.04
6376, ...	3.52	9.42	12.94	87.06
4869, ...	3.47	9.44	12.91	87.09
5670, ...	3.30	9.60	12 90	87.10
5870, ...	3.84	9.03	12.87	87.13
3254, ...	3.40	9.45	12.85	87.15
6972, ...	3.89	8.95	12.84	87.16
5658, ...	3 56	9.25	12.81	87.19
6978, ...	3.69	9.07	12.76	87.24
6516, ...	2.79	9.96	12.75	87.25
5868, ...	2.69	10.01	12.70	87.30
6464, ...	3 25	9.40	12.65	87.35
4877, ...	2.90	9.75	12.65	87.35
6976, ...	3.38	9.26	12.64	87.36
6982, ...	3.38	9 26	12.64	87.36
2884, ...	3.13	9 38	12.51	87.49
2880, ...	2.99	9.52	12.51	87.49
6450, ...	2.72	9.78	12.50	87.50
7068, ...	3.00	9.41	12.41	87 59
3732, ...	2.20	10.20	12.40	87.60
3882, ...	3.20	9.19	12.39	87.61
6456, ...	2.80	9.53	12.33	87 67
7060, ...	3.02	9.30	12.32	87.68
7072, ...	3.22	9.08	12.30	87.70
6502, ...	1.96	10.33	12 29	87.71
4867, ...	2.29	9.98	12.27	87.73
6970, ...	3 35	8.88	12.23	87.77
6374, ...	3.50	8.72	12 22	87.78
6460, ...	2.19	9.82	12.01	87.99
3262, ...	2.83	9.11	11.94	88 06
3268, ...	2.55	9.00	11.55	88.45

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6380,	1.42	10.10	11.52	88.48
6382,	1.46	10.03	11.49	88.51
5828,	2.62	8.14	10.76	89.24
6974,	2.17	4.73	6.90	93.10

Somerville.

	Class A.	Class B.	Total.
Samples received,	40	44	84
Passed on inspection,	3	22	25
Samples analyzed,	37	22	59
Above the standard (inc. samples passed),	9	27	36
Below the standard,	31	17	48

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5996,	5.85	10.63	16.48	83.52
6192,	6.81	9.61	16.42	83.58
6004,	3.75	10.29	14.04	85.96
5998,	2.65	11.34	13 99	86.01
6196,	3.70	9.43	13.13	86.87
7117,	3.39	9.68	13.07	86.93
6002,	2.41	10.58	12.99	87.01
6008,	3.41	9.50	12.91	87.09
6118,	3.34	9.37	12.71	87.29
6198,	3.31	9.29	12.60	87.40
5710,	2.76	9.84	12.60	87.40
6362,	3.54	8.80	12.34	87.66
6366,	2.37	9.94	12 31	87.69
5718,	3.31	8.94	12.25	87.75
6368,	2.19	10.03	12.22	87.78
6364,	2.21	9.96	12.17	87.83
4414,	2.36	9.80	12.16	87.84
6186,	2.68	9.41	12.09	87.91
7119,	3.02	8.96	11.98	88.02

Class A — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6010,	3.53	8.28	11.81	88.19
4362,	2.35	9.38	11 73	88.27
6194,	2.25	9.47	11.72	88.28
4412,	2.69	8.97	11.66	88.34
6190,	2.57	8.81	11.38	88.62
6372,	2.34	8.88	11.22	88.78
6370,	2.63	8.53	11.16	88 84
6360,	2.51	8.62	11.13	88.87
7123,	2.74	8.32	11.06	88.94
7113,	1.68	9.30	10.98	89.02
5712,	2.07	8.77	10.84	89.16
4352,	1.92	8.88	10.80	89.20
7111,	1.29	9.33	10.62	89.38
4356,	2.28	8.92	10.20	89.80
7115,	0.83	9.20	10.03	89.97
4364,	0.84	8.00	8.84	91.16
4360.	0.98	7.52	8.50	91.50

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3998,	13.38	11.22	24.60	75.40
3996,	13.67	8.98	22.65	77.35
6000,	5.25	11.39	16.64	83 36
3534,	3.38	10.33	13 71	86.29
6612,	3.49	10 05	13.54	86.46
6602,	3.35	9.53	12.88	87.12
6598,	3.28	9.48	12.76	87.24
7048,	2.85	9.69	12.54	87.46
4416,	2.55	9.92	12.47	87.53
7052,	2.80	9.52	12.32	87.68
3538,	2.93	9 36	12.29	87.71
6618,	3.33	8.89	12.22	87.78
5706,	3.33	8.79	12.12	87.88
4406,	2.65	9.22	11.87	88.13
6622,	2.95	8.86	11.81	88.19
6614,	3.29	8.50	11.79	88.21
7046,	2.92	8.73	11.65	88.35

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6604, ...	2.14	9.03	11.17	88.83
7121, ...	2.91	8.05	10.96	89.04
5708, ...	2.66	8.10	10.76	89.24
4408, ...	1.67	8.24	9.91	90.09
4410, ...	2.08	7.57	9.65	90.35

Gloucester.

	Class. A.	Class B.	Total.
Samples received, ...	11	53	64
Passed on inspection.	0	24	24
Samples analyzed, ...	11	29	40
Above the standard (inc. samples passed),	5	37	42
Below the standard, ...	6	16	22

Class. A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5794, ...	4.09	9.89	13.98	86.02
5804, ...	4.65	9.09	13.74	86.26
6958, ...	3.39	10.21	13.60	86.40
5796, ...	4.10	9.09	13.19	86.81
5800, ...	3.03	10.14	13.17	86.83
5802, ...	3.27	9.41	12 68	87.32
6152, ...	3.36	9.27	12.63	87.37
2698, ...	2 89	9.73	12.62	87.38
4318, ...	2.99	8.71	11.70	88.30
5798, ...	2.97	8.12	11.09	88.91
4947, ...	2.33	7.61	9.94	90 06

Class B.

6144, ...	5.00	9.64	14.64	85.36
6960, ...	4.44	10.07	14.51	85.49
6154, ...	4.40	9.95	14.35	85.65
6142, ...	4.64	9 66	14.30	81.70
2696, ...	4.00	10.21	14 21	85.79
2692, ...	3.84	10.04	13 88	86.12
6146, ...	4.21	9.66	13.87	86.13

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
2684, ...	3.85	9.75	13.60	86,40
4322, ...	3.66	9.70	13.36	86.64
2694, ...	3.43	9 90	13.33	86.67
2682, ...	3.63	9.57	13 20	86.80
2686, ...	3.66	9.48	13.14	86.86
6150, ...	3.37	9.70	13.07	86.93
2688, ...	3.38	9.60	12.98	87.02
4939, ...	3.50	9.29	12.79	87.21
6148, ...	3.61	9.08	12.69	87.31
2680, ...	3.18	9.40	12.58	87.42
6952, ...	3.50	9.03	12.53	87.47
4933, ...	3.36	9.15	12.51	87.49
2690, ...	3.38	8.75	12.13	87.87
6946, ...	3.02	9.07	12.09	87.91
4194, ...	3.40	8.60	12.00	88.00
6950, ...	2.80	9.15	11.95	88 05
6948, ...	2.83	9.09	11.92	88.08
4196, ...	2.68	9.16	11.84	88.16
4951, ...	2.06	9.63	11.69	88.31
4941, ...	2.76	8.91	11.67	88.33
6956, ...	3.21	8.41	11.62	88.38
4204, ...	2.45	8 76	11.21	89.79

Worcester.

	Class A.	Class B.	Total.
Samples received, ...	2	58	60
Passed on inspection, ...	2	18	20
Samples analyzed, ...	0	40	40
Above the standard (inc. samples passed), .	2	32	34
Below the standard, ...	0	26	96

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
8375, ...	4.38	10.38	14.76	85.24
8231, ...	4.25	10.37	14.62	85.38
8225, ...	3.89	10.52	14.41	85.59

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
8229,	4.00	9.86	13.86	86.14
4779,	3.84	9 96	13 80	86.20
8233,	3.70	10.09	13.79	86.21
8237,	3.68	10.09	13.77	86.23
4785,	3.22	10.42	13.64	86.36
4795,	3.00	10.41	13.41	86.59
3713,	2.92	10.31	13.23	86.77
8361,	3.53	9.79	13.32	86.68
8363,	3.72	9.58	13.30	86.70
4781,	2.95	10.27	13.22	86.78
4789,	3.23	9.90	13.13	86.87
3721,	2.67	10.28	12 95	87.05
3715,	2.41	10 53	12.94	87.06
8359,	3.55	9.36	12.91	87.09
9045,	3.27	9.64	12.91	87.09
8223,	3.02	9.89	12.91	87.09
8227,	2.92	9.88	12.80	87.20
8371,	2.78	9.97	12.75	87.25
8357,	3.06	9.64	12.70	83.30
4777,	2.28	10.34	12.62	87.38
4771,	2.50	9.97	12.47	87 53
9037,	3.20	9 24	12.44	87.56
3705,	2.89	9.52	12.41	87.59
8369,	3.21	9.18	12.39	87.61
8235,	2.60	9.78	12.38	87.62
9053,	3.07	9.30	12.37	87.63
4769,	2.89	9.34	12.23	87.77
4784,	2.26	9.85	12.11	87.89
3711,	2.33	9.75	12.08	87.92
3717,	-	-	12.06	87.94
9039,	2.65	9.40	12.05	87.95
9033,	2.27	9.74	12.01	87.99
8381,	2.57	9.37	11.94	88.06
8355,	2.66	9.12	11.78	88.22
3709,	2.04	9.71	11.75	88 25
4787,	2.19	9.38	11.57	83.43
4767,	1.75	9.75	11.50	88.50

Lynn.

	Class A.	Class B.	Total.
Samples received, ...	8	44	52
Passed on inspection, ...	1	11	12
Samples analyzed, ...	7	33	40
Above the standard (inc. samples passed),	1	24	25
Below the standard, ...	7	20	27

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3224, ...	2.65	9.82	12.47	87.53
2908, ...	3 08	9.37	12.45	87.55
3226, ...	1.57	9.70	11.27	88.73
2904, ...	1.41	9.76	11.17	88.83
2906, ...	2.40	8.38	10.78	89.22
2910, ...	2.20	7.83	10.03	89.97
3222, ...	1.56	8.01	9.57	90.43

Class B.

6394, ...	3.13	10 80	13 93	86.07
6802, ...	4.19	9.64	13.83	86.17
4992, ...	3.98	9.73	13.71	86 29
6808, ...	3.38	10.09	13.47	86 53
6800, ...	3.40	10.03	13.43	86 57
6388, ...	2.72	10.71	13.43	86.57
6262, ...	3.99	9.38	13.37	86.63
6386, ...	3.01	10.33	13.34	86.66
6798, ...	3.35	9.96	13.31	86 69
4752, ...	3.14	10.12	13.26	86.74
4980, ...	3.22	9.95	13.17	86.83
6806, ...	3.53	9.52	13.05	86.95
6390, ...	2.24	10.77	13 01	86.99
6264, ...	3.76	9.06	12.82	87.18
6810, ...	2.64	10.16	12.80	87.20
6804, ...	3.28	9.47	12.75	87.25
6258, ...	3.75	8.98	12.73	87.27
6250, ...	3.64	9.04	12.68	87.32
4990, ...	3.20	9.47	12 67	87.33

Class B — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4750, ...	2 85	9.71	12.56	87.44
4988, ...	2 90	9.58	12.48	87.52
6252, ...	3.16	9.30	12.46	87.54
4758, ...	3.28	9 15	12 43	87.57
4756, ...	3.18	9.25	13.43	87 57
6256, ...	3.67	8.60	12 27	87.73
6812, ...	2.63	9.51	12.14	87.86
3220, ...	2.98	8 76	11.74	88.26
4994, ...	2.63	8.97	11.60	88.40
6260, ...	3.31	8.05	11.36	88.64
4984, ...	2.93	8.14	11.07	88 93
6254, ...	3.10	7.73	10.83	89.17
3216, ...	2.18	8.50	10.68	89 32
4986, ...	1.24	9.42	10.66	89.34

Chelsea.

	Class A.	Class B.	Total.
Samples received, ...	34	6	40
Passed on inspection, ...	6	1	7
Samples analyzed, ...	28	5	33
Above the standard (inc. samples passed),	14	4	18
Below the standard, ...	20	2	22

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5608, ...	4.29	10.69	14 98	85.02
5898, ...	5.21	9.63	14.84	85.16
5600, ...	4.28	10.03	14.31	85.69
5606, ...	3.75	10 51	14 26	85.74
2930, ...	3.98	9.69	13.67	86.33
2712, ...	3.37	10 17	13.54	86.46
2716, ...	3.72	9.57	13.29	86.71
5598, ...	3 00	10 13	13.13	86.87
5594, ...	3.07	9.89	12 96	87.04

Class A — Concluded.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
8847, ...	3.48	9.43	12.91	87.09
8845, ...	3.28	9.60	12.88	87.12
2938, ...	2.79	10.05	12.84	87.16
8849, ...	3.01	9.38	12.39	87.61
8857, ...	2.95	9.43	12.38	87.62
2714, ...	2.99	9.28	12.27	87.73
5904, ...	2.70	9.54	12.24	87.76
2932, ...	3.40	8.70	12.10	87.90
8851, ...	3.03	8.58	11.61	88.39
2722, ...	2.62	8.82	11.44	88.56
5896, ...	2.97	8.24	11.21	88.79
2710, ...	2.26	8.74	11.00	89.00
2718, ...	1.40	9.30	10.70	89.30
2724, ...	3.25	7.27	10.52	89.48
5610, ...	1.89	8.45	10.34	89.66
2720, ...	2.33	7.25	9.58	90.42
5612, ...	1.68	7.29	8.97	91.03
5602, ...	1.71	7.12	8.83	91.17
5604, ...	1.43	7.14	8.57	91.43

Class B.

5594, ...	4.20	10.61	14.81	85.19
5596, ...	4.20	10.61	14.81	85.19
2936, ...	3.63	9.73	13.36	86.64
5902, ...	3.06	9.38	12.44	87.56
2934, ...	2.73	8.99	11.72	88.28

Malden.

	Class A.	Class B.	Total.
Samples received, ...	21	16	37
Passed on inspection, ...	3	5	8
Samples analyzed, ...	18	11	29
Above the standard (inc. samples passed),	6	8	14
Below the standard, ...	15	8	23

Class A.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5930, ...	2.74	11.02	13.76	86.24
6330, ...	3.48	10.21	13.69	86.31
5924, ...	3.12	9.98	13.10	86.90
5934, ...	2.65	10.34	12.99	87.01
5936, ...	3.04	9.84	12.88	87.12
3582, ...	2.90	9.77	12 67	87.33
3570, ...	3.21	9.43	12.64	87.36
6160, ...	3.18	9.36	12.54	87.46
5922, ...	3.46	9.02	12.48	87.52
6164, ...	3.03	9.45	12.48	87.52
6156, ...	2 96	9.45	12.41	87.59
3576, ...	2.38	9.98	12.36	87.64
5926, ...	2.61	9.54	12.15	87.85
3572, ...	2.20	9 91	12.11	87.89
5928, ...	2.46	9.54	12.00	88.00
6328, ...	2.45	9.21	11.66	88 34
5932, ...	2.46	8.87	11.33	88 67
6322, ...	2.81	7.91	10.72	89.28

Class B.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6332, ...	5.11	10.11	15.22	84.78
6318, ...	3.81	9.32	13.13	86.87
6320, ...	3.75	9.36	13.11	86.89
3578, ...	3.09	9.81	12.90	87.10
6158, ...	3.01	9.52	12.53	87.47
4210, ...	2.68	9.72	12.40	87 60
6162, ...	2.77	9.49	12.26	87.74
6324, ...	3.62	7.99	11.61	88.39
6326, ...	3.58	8.01	11.59	88.41
4424, ...	2.30	9.13	11.43	88.57
4222, ...	2.36	8.87	11.23	88.77

New Bedford.

	Class A.	Class B.	Total.
Samples received, ...	9	28	37
Passed on inspection, ...	3	6	9
Samples analyzed, ...	6	22	28
Above the standard (inc. samples passed),	5	16	21
Below the standard, ...	4	12	16

Class A.

Inspector's Number.	Fat.	Solids, Not Fat.	Total Solids.	Water.
3385,	3.84	10.05	13.89	86.11
3389,	3.41	9.94	13.35	86.65
3383,	3.11	9.72	12.83	87.17
3381,	3.13	9.60	12.73	87.27
3387,	3.12	9.44	12.56	87.44
8691,	2.29	8.12	10.41	89.59

Class B.

8673,	4.09	9.95	14.04	85.96
3397,	4.14	9.72	13.86	86.14
8675,	3.52	10.15	13.67	86.33
3395,	4.15	9.42	13.57	86 43
3391,	4.07	9.48	13.55	86 45
6111,	2.98	10.49	13.47	86.53
6117,	3.26	9 94	13.20	86.80
8683,	3 52	9.65	13.17	86.83
3377,	3.63	9.48	13.11	86.89
8699,	3.57	9.45	13.02	86.98
8697,	3.43	9.52	12.95	87.05
8677,	3.69	9.23	12.92	87.08
6107,	2.76	10.01	12.77	87.23
6123,	2.85	9.78	12.63	87.37
3393,	3.28	9.28	12.56	87.44
6113,	2 86	9.66	12.52	87.48
8681,	3.33	9.10	12.43	87.57
3379,	3.19	9.06	12.25	87.75
8689,	3.16	8.69	11.85	88.15
3375,	2.53	9.21	11.74	88.26
8687,	2.90	8.76	11.66	88.34
8679,	2.90	8.71	11.61	88.39

Fitchburg.

	Class B.
Samples received,	30
Passed on inspection,	12
Samples analyzed,	18
Above the standard (including samples passed),	20
Below the standard,	10

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
6730, ...	3.16	9.50	12.66	87.34
6738, ...	3 63	8.89	12.52	87.48
6734, ...	3.12	9.39	12.51	87.49
3708, ...	3.14	9.35	12.49	87.51
6722, ...	2.10	9.82	11.92	88.08
3724, ...	2 79	9.09	11.88	88.12
3726, ...	2.49	9.37	11.86	88.14

Haverhill.

	Classes A and B.
Samples received, ...	26
Passed on inspection, ...	15
Samples analyzed, ...	11
Above the standard (including samples passed), .	18
Below the standard, ...	8

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3664, ...	3.64	10.27	13.91	86.09
3672, ...	4.25	9.56	13.81	86.19
3668, ...	3.39	9-86	13.25	86.75
6704, ...	3.49	9.40	12.89	87.11
3680, ...	3 17	9.65	12.82	87.18
6716, ...	3.45	9.33	12.78	87.22
6714, ...	3.37	9.30	12 67	87.33
6718, ...	3.32	8.98	12.30	87.70
3676, ...	2.44	9.75	12.19	87.81
6702, ...	2.66	8.87	11.53	88.47
6594, ...	0.66	10.37	11.03	88.97

Brockton.

	Classes A and B.
Samples received, ...	24
Passed on inspection, ...	15
Samples analyzed, ...	9
Above the standard (including samples passed), .	19
Below the standard, ...	5

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3937, ...	3.81	9.95	13.76	86.24
8163, ...	3.35	10.22	13.57	86.43
3935, ...	3.57	9.78	13.35	86.65
8145, ...	3.69	9.61	13.30	86.70
8165, ...	3.26	9.43	12.69	87.31
3939, ...	2.91	9.72	12.63	87.37
8153, ...	3.39	9.17	12.56	87.44
3947, ...	3.09	9.28	12 37	87.63
8159, ...	2.10	10.20	12.30	87.70

Waltham.

	Classes A and B.
Samples received, ...	15
Passed on inspection, ...	5
Samples analyzed, ...	10
Above the standard (including samples passed), .	8
Below the standard, ...	7

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4056, ...	3.35	10.11	13.46	86.54
4052, ...	3.52	9.75	13.27	86.73
6894, ...	3.04	10.19	13.23	86.77
6888, ...	3.26	9.65	12.91	87.09
6898, ...	3.32	9.37	12.69	87.31
4062, ...	2.50	10.11	12.61	87.39
4060, ...	2.09	10.01	12.10	87.90
6892, ...	3.22	8.76	11.98	88.02
6902, ...	2.63	9.10	11.73	88.27
6890, ...	3.52	8.11	11.63	88.37

Taunton.

	Class B.
Samples received,	8
Samples analyzed,	8
Above the standard,	6
Below the standard,	2

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3879,	4.36	10.40	14.76	85.24
3893,	4.10	9.90	14.00	86.00
3887,	3.79	9.99	13.78	86.22
3877,	3.63	9.47	13.10	86.90
3885,	3.31	9.79	13.10	86.90
3883,	3.36	9.71	13.07	86.93
3881,	3.23	9.26	12.49	87.51
3891,	2.71	9.23	11.94	88.06

Newton.

	Classes A and B.
Samples received,	8
Samples analyzed,	8
Above the standard,	5
Below the standard,	3

Inspector's Number.	Fat.	Solids, Not Fat.	Total Solids.	Water.
7867,	4.27	9.60	13.87	86.13
7853,	3.30	10.37	13.67	86 33
7859,	3.54	10.05	13.59	86.41
7861,	3.50	9.93	13.43	86.57
7857,	3.73	9.31	13.04	86 96
7863,	3.62	9.32	12.94	87.06
7865,	3.19	9.71	12.90	87.10
7855,	2.73	9.76	12.49	87.51

Towns.

Athol.	Hudson.	Nantucket.
Ayer.	Hyde Park.	Natick.
Beverly.	Ipswich.	Plymouth.
Blackstone.	Leominster.	Quincy.
Brookline.	Marblehead.	Spencer.
Clinton.	Marlborough.	Stoneham.
Cottage City.	Medford.	Ware.
Everett.	Melrose.	Webster.
Framingham.	Milford.	Winthrop.
Gardner.	Nahant.	Woburn.

	Classes A and B.
Samples received, ...	355
Passed on inspection, ...	133
Samples analyzed, ...	222
Above the standard (including samples passed), .	218
Below the standard, ...	137

Athol.

Inspector's Number.	Fat.	Solids, Not Fat.	Total Solids.	Water.
4634, ...	2.28	10.73	13.01	86.99
4646, ...	3.02	9.09	12.11	87.89
4630, ...	2.35	9.62	11.97	88.03
4640, ...	0.81	10.58	11.39	88.61

Ayer.

Inspector's Number.	Fat.	Solids, Not Fat.	Total Solids.	Water.
3808, ...	3.85	9.59	13.44	86.56
3812, ...	4.14	9.10	13.24	86.76
3810, ...	3.34	9.69	13.03	86.97
3820, ...	3.39	9.33	12.72	87.28
5586, ...	3.25	8.94	12.19	87.81
3818, ...	2.76	9.28	12.04	87.96
3816, ...	0.32	9.87	10.19	89.81

Beverly.

Inspector's Number.	Fat.	Solids, Not Fat.	Total Solids.	Water.
4232, ...	3.41	9.77	13.18	86.82
4236, ...	2.87	9.84	12.71	87.29
4234, ...	2.34	10.06	12.40	87.60
4242, ...	2.96	9.40	12.36	87.64
4238, ...	2.45	9.71	12.16	87.84
4228, ...	1.86	9.40	11.26	88.74

BLACKSTONE.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
8251, ...	4.26	9.67	13.93	86.07
8241, ...	3.18	9.91	13.09	86.91
8245, ...	3.58	9.41	12.99	87.01
8247, ...	3.36	9.73	12.09	87.91

BROOKLINE.

5949, ...	3.44	9.44	12 88	87 12
5945, ...	3.21	9.51	12.72	87 28
5947, ...	2.90	9.78	12.68	87.32
5935, ...	2.38	10.30	12.68	87.32

CLINTON.

6584, ...	4.15	9.83	13.98	86.02
4576, ...	3.85	10.07	13.92	86.08
4132, ...	3 28	10.15	13.43	86.57
6578, ...	3.35	9.92	13.27	86.73
6586, ...	3.68	9.55	13.23	86.77
4560, ...	3.66	9.55	13.21	86.79
6568, ...	3.28	9.58	12.86	87.14
3312, ...	3.15	9 55	12.70	87.30
4558, ...	3.17	9.42	12.59	87.41
3306, ...	2.16	10.23	12.39	87.61
6582, ...	3 08	9.25	12.33	87.67
6574, ...	2.92	9 33	12.25	87.75
3308, ...	2.08	9.96	12 04	87.96
4562, ...	2.44	9.59	12.03	87 97
4566, ...	2.81	9.06	11.87	88.13
4120, ...	1.94	9.74	11.68	88.32
4554, ...	1.52	9.50	11.02	88.98
4572, ...	0.39	10.15	10.54	89.46

COTTAGE CITY.

3196, ...	5.11	9.98	15.09	84.91
3210, ...	4.16	9.63	13.79	86.21
3208, ...	3.49	9.70	13.19	86.81

Everett.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
3588, ...	16.07	8.40	24.47	75.53
3586, ...	3.07	9.39	12.46	87.54
3590, ...	2.80	9.39	12.19	87.81
3592, ...	2.29	9.09	11.38	88 62
4012, ...	1.17	9.35	10.52	89.48
3584, ...	3.20	9.60	12.80	87.20
4004, ...	3.38	9.21	12.59	87.41
4008, ...	2.51	9.91	12.42	87.58
3594, ...	2.60	9.51	12.11	87.89

Framingham.

3465, ...	4.10	9.69	13.79	86.21
3362, ...	3 75	9.83	13.58	86.42

Gardner.

5978, ...	4.34	10.00	14 34	85.66
5972, ...	4.18	9.68	13.86	86.14
5976, ...	3.70	9 54	13.24	86.76
5980, ...	3.62	9.22	12.84	87.16
5982, ...	3.64	9.18	12.82	87.18
5974, ...	3.53	9.09	12·62	87.38
5970, ...	2.62	9.50	12.12	87.88

Hudson.

6747, ...	5.35	10.46	15.81	84.19
6751, ...	4.15	10.08	14.23	85.77
6759, ...	3.83	10.22	14.05	85.95
6757, ...	3.56	10.29	13.85	86.15
6761, ...	2.91	10.46	13.37	86.63
6755, ...	3.32	9.11	12.43	87.57
6753, ...	3.15	9.22	12.37	87.63
6749, ...	2.80	9.44	12.24	87.76
6745, ...	2.54	9 47	12.01	87.99

HYDE PARK.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5981,	3.72	9.31	13.03	86.97
5975,	3.72	9.27	12.99	87.01
5967,	3.23	9.34	12.57	87.43

IPSWICH.

2828,	3.39	9.62	13.01	86.99
2832,	3.42	9.33	12.75	87.25
2830,	3.57	9.10	12.67	87.33

LEOMINSTER.

4834,	3.32	9.78	13.10	86.90
4828,	3.08	10.01	13.09	86.91
4826,	3.21	9.66	12.87	87.13
4832,	2.89	9 77	12.66	87.34
4822,	2.39	9.16	12.55	87.45

MARBLEHEAD.

4506,	3.31	10 32	13.63	86.37
4508,	3.57	10.06	13.63	86 37
4510,	3.72	9.40	13.12	86.88
4516,	2.83	9.75	12.58	87.42
4500,	2.89	9 67	12.56	87.44
4502,	2.78	9.35	12.13	87.87
4514,	2.21	9.71	11.92	88.08

MARLBOROUGH.

8391,	3.57	9.38	12.95	87.05
8413,	2.96	9.72	12.68	87.32
8387,	3.22	9.35	12.57	87.43
8395,	2.69	9.63	12 32	87.68
8409,	2.67	9.53	12.20	87.80
8401,*	0.15	9.59	9.74	90 26
8389,*	0.12	9.59	9.71	90.29

* Sold as "skimmed."

MEDFORD.

INSPECTOR'S NUMBER.	Fat.	Solids, not Fat.	Total Solids.	Water.
6474, ...	5.02	10.05	15.07	84.93
6920, ...	4.37	9.31	13.68	86.32
6478, ...	3.44	9.67	13.11	86.89
6480, ...	3.30	9.38	12.68	87.32
6476, ...	3.59	8 87	12.46	87.54
6482, ...	3.54	8.51	12.05	87.95
6922, ...	2.07	9 64	11.71	88.29
5570, ...	2.83	8.50	11.33	88.67
5562, ...	3.02	8.27	11.29	88.71
6918, ...	2.00	9.27	11.27	88.73
5564, ...	2.53	8.44	10 97	89.03
5568, ...	2.75	7.67	10.42	89.58
5566, ...	2.65	7.69	10 34	89.66
6924, ...	1.79	8.54	10.33	89.67

MELROSE.

7020, ...	4.60	10.01	14 61	85.39
7028, ...	3.71	10.00	13.71	86.29
7022, ...	3.17	9.65	12.82	87.18
7030, ...	2.54	9.80	12.34	87.66
7018, ...	2.72	9.49	12.21	87.79
7026, ...	2.67	9.52	12.19	87.81
7024, ...	2.44	9.64	12.08	87.92

MILFORD.

6041, ...	4.26	10.46	14.72	85.28
6037, ...	4.07	10.26	14.33	85 67
6045, ...	3.68	9.87	13.55	86.45
6043, ...	2.89	9.75	12.64	87.36
6035, ...	2.80	9.84	12.64	87.36
6051, ...	2.72	9.62	12.34	87.66

NAHANT.

3212, ...	2.92	9.58	12.50	87.50
3214, ...	2.21	9.48	11.69	88.31

Nantucket.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4671,	3.12	9.28	12.40	87.60
4673,	2.11	9.13	11.24	88.76
4675,	2 33	7.35	9.68	90 32
Natick.				
3247,	4.77	11.33	16.10	83 90
8633,	4.19	9.40	13.59	86.41
3259,	3.11	10.38	13.49	86.51
3253,	4.09	9.10	13.19	86.81
3251,	4.25	8.91	13.16	86 84
3261,	3.14	9.83	12.97	87.03
3249,	3.04	9.90	12.94	87.06
8645,	3.37	9 50	12.87	87.13
8631,	3.55	9.31	12.86	87.14
8643,	3.20	9 38	12.58	87.42
3255,	3.70	8.51	12.21	87.79
8651,	3.89	8.15	12.04	87.96
8649,	2.75	9.29	12.04	87.96
8639,	2.93	9.05	11.98	88.02
8629,	3.19	8.71	11.90	88.10
3257,	2.60	8.78	11.38	88.62
Plymouth.				
3489,	5.49	10.25	15.74	84.26
3487,	4.44	10.34	14.78	85.22
5767,	2.88	10.94	13.82	86.18
3497,	4.51	9.14	13.65	86.35
5763,	3.67	9.74	13.41	86.59
3485,	3.82	9.37	13.19	86.81
5755,	3.06	9.94	13.00	87.00
3499,	3 27	9.68	12.95	87.05
3491,	4.68	8.17	12.85	87.15
3495,	3.35	9.40	12.75	87.25
3481,	2.08	9.27	11.35	88.65
3493,	2.09	9.05	11.14	88.86
3483,	3.02	8.02	11.04	88.96
757,	2.44	8.22	10.66	89.34

QUINCY.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
8843, ...	4.40	9.21	13.61	86.39
8841, ...	3.38	9.41	12.79	87.21
8831, ...	3.25	8.84	12.09	87.91
8833, ...	1.48	9.61	11.09	88 91
SPENCER.				
6261, ...	4.40	10.63	15.03	84.97
6273, ...	3.42	10.24	13.66	86 34
6269, ...	3.52	9.75	13.27	86 73
6267, ...	3.07	10.06	13.13	86.87
6263, ...	2.92	9.74	12.66	87.34
STONEHAM.				
4732, ...	3.35	10.60	13.95	86.05
4726, ...	2.61	11.10	13.71	86.29
4744, ...	2.62	10.20	12.82	87.18
4736, ...	2.66	10.06	12.72	87.28
4742, ...	–	–	10.40	89.60
WARE.				
8775, ...	8.49	9.06	17.55	82.45
8777, ...	3.90	9.60	13.50	86 50
8781, ...	3.40	10.00	13.40	86.60
8779, ...	3.62	9.74	13.36	86.64
8789, ...	3.00	10.00	13.00	87.00
8787, ...	3.42	9.15	12.57	87.43
8785, ...	3.40	9.00	12.40	87.60
8783, ...	2.40	9.30	11.70	88.30
WEBSTER.				
8869, ...	4.39	9.66	14.05	85.95
8865, ...	4.09	9.52	13 61	86.69
8879, ...	3.61	9.15	12.76	87.24
8871, ...	2.82	9.90	12.72	87.28
8877, ...	1.54	9.54	11.08	88.92
8861, ...	1.68	9.12	10.80	89.20

Winthrop.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4340,	4.53	8.82	13.35	86.65
4334,	3.36	8.85	12.21	87.79
4344,	2.29	9.71	12.00	88.00
4338,	3.21	8.73	11.94	88.06
4342,	2.29	8.88	11.17	88.83

Woburn.

Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
4882,	3.82	11.25	15.07	84.93
6224,	3.89	10.26	14.15	85.85
6226,	4.03	10.08	14.11	85.89
6220,	3.52	10.32	13.84	86.16
6228,	3.70	10.11	13.81	86.19
4870,	3.91	9.76	13.67	86.33
6222,	3.60	10.00	13.60	86.40
4482,	4.93	8.43	13.36	86.64
6542,	3.72	9.52	13.24	86.76
4488,	2.92	10.27	13.19	86.81
4864,	3.89	9.27	13.16	86.84
6532,	3.58	9.56	13.14	86.86
6230,	3.38	9.72	13.10	86.90
6538,	3.50	9.52	13.02	86.98
4878,	3.40	9.56	12.96	87.04
6534,	3.42	9.38	12.80	87.20
4876,	2.67	9.13	12.80	87.20
4866,	3.62	9.09	12.71	87.29
4868,	3.65	8.98	12.63	87.37
6218,	3.56	8.99	12.55	87.45
4480,	3.03	9.37	12.40	87.60
4476,	2.84	9.53	12.37	87.63
4880,	2.72	9.63	12.35	87.65
3650,	2.96	8.93	11.89	88.11
3646,	2.86	8.93	11.79	88.21
4874,	2.55	9.19	11.74	88.26
3648,	2.64	8.90	11.54	88.46
4872,	2.57	8.95	11.52	88.48
4484,	2.12	8.37	10.49	89.51

CLASS C.

SAMPLES OBTAINED FROM PRODUCERS SUSPECTED OF ADULTERATING THEIR MILK.

Samples received, ...	245
Passed on inspection, ...	97
Samples analyzed, ...	148
Above the standard (including samples passed), . . .	125
Below the standard, ...	120

WHERE OBTAINED.	Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.	
Northborough, . . .	2946	3.22	9.50	12.72	87.28	*
" . . .	2950	2.96	9.28	12.24	87.76	
" . . .	2952	3.10	9.38	12.48	87.52	
" . . .	2954	3.14	9.53	12.67	87.33	*
" . . .	2956	3.44	9.71	13.15	86 85	
" . . .	2960	2.83	9.15	11 98	88.02	
" . . .	2962	3.30	9.28	12 58	87.42	
Wayland, ...	3112	2.87	9.82	12.69	87.31	
Weston, ...	3123	2.45	8.86	11.31	88.69	
"	3126	3.15	9.49	12.64	87.36	
"	3128	3.13	8.99	12 12	87.88	*
"	3130	3.68	9.10	12.78	87.22	
Dunstable, ...	3156	1.63	9.77	11.40	88.60	
"	3158	2.61	9.35	11.96	88.04	
"	3162	2.35	9 33	11.68	88.32	
"	3166	1.62	8.95	10.57	89.43	
Holliston, ...	3344	3.33	7.93	11.26	88.74	
"	3348	3.24	8.10	11.34	88.66	*
"	3352	2.43	7.73	10.16	89.84	
Weston, ...	3476	2.56	10.09	12.65	87.35	
Shirley, ...	3528	0.77	9.13	9.90	90.10	
Groton, ...	4064	3.07	9.65	12.72	87.28	*
"	4072	3.15	9.36	12.51	87.49	
Westborough, . . .	4113	2.93	9.50	12.43	87.57	*
" . . .	4115	3 58	9.11	12.69	87.31	
" . . .	4117	3.06	8.26	11.32	88.68	*
" . . .	4123	3.05	8.27	11.32	88.68	

* One dairy.

Class C — Continued.

Where Obtained.	Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.
Northborough, . . .	4163	3.00	9.24	12.24
" . . .	4173	3.81	10 01	13.82
" . . .	4175	3.18	9.19	12 37
" . . .	4177	4.20	9.73	13.93
" . . .	4179	2.85	9.37	12.22
Salem, ...	4296	3.43	10.26	13.69
Swansea, ...	4305	2.82	10 30	13.12
"	4307	1.78	9.09 *	10.87
"	4309	2.56	9 64	12 20
"	4315	2 27	9.04	12.31
Fall River, ...	4317	2.92	10.13	13.05
Bolton, ...	4327	1.84	9.77	11.61
"	4329	1.26	9.57	10.83
Northborough, . . .	4341	2.58	8.28	10.86
" . . .	4355	3 03	8.78	11.81
Marlborough, . . .	4433	1.84	9.58	11.42
" . . .	4435	2.18	9.71	11.89
" . . .	4439	3.08	9.41	12.49
" . . .	4441	2.81	10.21	13.02
Upton, ...	4445	3.39	8.34	11.73
"	4447	2 47	7.17	9.64
"	4449	2.72	8.72	11.44
"	4451	2.85	8.15	11.00
"	4453	2.82	9.05	11.87
Berlin, ...	4459	2.00	10.23	12.23
"	4461	2.57	10.02	12.59
"	4463	3 38	9.67	13.05
"	4465	3.44	10.22	13.66
Chelmsford, . . .	4469	3 29	9.97	13.26
Framingham, . . .	4481	2 62	9.78	12.40
Stow, ...	4555	3.16	6.38	9.54
"	4557	2.18	6 58	8 76
"	4559	2.52	6.62	9.14
"	4561	2.54	6 02	8.56
"	4563	2.29	5.81	8.10
"	4565	1.87	6 27	8.14
"	4567	2.02	6.62	8.64

* One dairy.

Class C—Continued.

Where Obtained.	Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
Warren, ...	4581	2.84	9.06	11.90	88.10 *
"	4583	2.53	9.30	11.83	88.17 *
"	4587	2.30	8.92	11.22	88.78 *
"	4589	3.26	8.84	12.10	87.90 *
"	4593	2.86	8.57	11.43	88.57 *
Concord, ...	4597	1.48	9.62	11.10	88.90 *
"	4599	2.67	9.96	12.63	87.37 *
"	4603	2.38	9.96	12.34	87.66 *
"	4605	3.30	9.54	12.84	87.16
"	4609	1.83	10.06	11.89	88.11
"	4611	3.18	9.36	12.54	87.46
Hardwick, ...	4639	2.78	9.65	12.43	87.57 *
"	4641	2.59	9.52	12.11	87.89 *
"	4647	3.04	9.44	12.48	87.52 *
"	4649	1.56	9.52	11.08	88.92 *
"	4651	3.40	9.87	13.27	86.73 *
Concord, ...	4653	2.46	6.79	9.25	90.75 *
"	4655	1.82	6.51	8.33	91.67 *
"	4657	3.86	6.36	10.22	89.78 *
"	4663	2.17	9.76	11.93	88.07
Norwood, ...	4853	2.13	10.59	12.72	87.28 *
"	4855	4.27	10.05	14.32	85.68 *
"	4859	3.85	9.41	13.26	86.74 *
Harvard, ...	5574	3.93	9.41	13.34	86.66 *
"	5576	3.76	9.39	13.15	86.85 *
"	5578	3.52	9.14	12.66	87.34 *
"	5580	4.00	9.33	13.33	86.67 *
"	5584	3.86	9.54	13.40	86.60 *
Chelmsford, ...	6172	3.28	8.68	11.96	88.04 *
"	6174	3.53	8.96	12.49	87.51 *
"	6176	2.47	8.25	10.72	89.28 *
"	6178	3.69	8.32	12.01	87.99 *
"	6180	2.96	8.73	11.69	88.31 *
"	6182	2.89	8.72	11.61	88.39 *
"	6184	2.74	8.70	11.44	88.56 *
Billerica, ...	6356	1.60	10.52	12.12	87.88 *
"	6358	2.68	10.17	12.85	87.15 *

* One dairy.

Class C — Continued.

WHERE OBTAINED.	Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.	
Harvard, ...	6561	1.36	7.07	8.43	91.57	
"	6563	2.19	6.39	8.58	91 42	*
"	6565	2.62	7.63	10.25	89.75	
Billerica, ...	6846	3 41	8.49	11.90	88.10	
"	6848	3.14	7.92	11.06	88.94	*
"	6850	3.49	8.53	12.02	87.98	
"	6852	3.20	8.14	11.34	88.66	
Bedford, ...	6854	2 79	8.01	10.80	89.20	
"	6856	3.01	7.87	10.88	89.12	
"	6858	3.17	8.07	11.24	88.76	*
"	6860	2.90	8.13	11.03	88.97	
Sudbury, ...	6935	4.55	11.04	15.59	84.41	
Andover, ...	7032	5.43	9.39	14.82	85.18	*
"	7034	3.63	9 31	12.94	87.06	
"	7036	3.14	9.26	12.40	87.60	
"	7038	3.17	9.31	12.48	87.52	
"	7040	3.24	9.38	12.62	87.38	
"	7042	3.45	9.41	12.86	87.14	*
"	7044	3.12	9.08	12.20	87.80	
Westport, ...	7181	3.60	8.48	12.08	87.92	
"	7183	3 41	8.03	11.44	88.56	*
"	7185	2.61	7.55	10.16	89 84	
"	7187	3.90	9.73	13.63	86 37	*
"	7189	2.22	11.36	13.58	86.42	
"	7191	3.72	10.33	14.05	85.95	
"	7193	4.16	10.31	14.47	85.53	
"	7195	3.22	9.96	13.18	86.82	
"	7197	2.94	9.72	12.66	87.34	
Walpole, ...	7939	3.13	8.01	11.14	88.86	*
"	7943	2.78	8.37	11.15	88.85	
Norwood, ...	7945	3.16	9.02	12.18	87 82	*
"	7947	2.83	9.40	12.23	87.77	
"	7953	1.69	10.25	11.94	88.06	
Medway, ...	8535	2.57	9 35	11.92	88.08	
"	8537	2.30	9.73	12.03	87.97	*
"	8539	1.77	9.40	11.17	88 83	

* One dairy.

Class C — Concluded.

Where Obtained.	Inspector's Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
Sudbury, ...	8265	3.07	8.19	11.26	88.74 *
"	8267	2.31	7.49	9.80	90.20 *
"	8269	4.11	9.80	13.91	86.09 *
Medway, ...	8565	4.10	9.37	13.47	86.53 *
"	8567	4.03	9.65	13.68	86.32 *
"	8569	3.73	9 61	13.34	86 66 *
"	8821	2.39	9.73	12.12	87.88 *
"	8823	2.49	9.57	12.06	87.94 *
"	8825	2.99	9.80	12.79	87.21 *
Millis, ...	8827	3.60	9.27	12.87	87.13 *
"	8829	2.61	9.37	11.98	88 02 *

* One dairy.

Class D.

Samples received from Unknown Sources (Private Individuals and Public Institutions).

Samples received,	13
Above the standard,	9
Below the standard,	4

Mark or Number.	Fat.	Solids, not Fat.	Total Solids.	Water.
5034,	3.53	10 40	13 93	86.07
	4.51	10 40	13.91	86.09
	4.24	9.59	13.83	86.17
	4 07	9.59	13.66	86.34
	4.11	9.53	13.64	86.36
B.,	3.31	10.20	13.51	86.49
	3.86	9.57	13.43	86.57
	3.98	9.44	13.42	86.58
J. M.,	3.20	9.83	13.03	86.97
	3.83	9.11	12 94	87.06
	3.91	8.83	12.74	87.26
5033,	2.73	9.94	12.67	87.33
C 3,	3.33	8.88	12 21	87.79

CLASS E.

SAMPLES OF KNOWN PURITY.

Samples received,	176
Above the standard,	105
Below the standard,	71

Inspector's No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
3364	-	Littleton,	-	-	- -	- - -	2.61	9 27	11.88	88.12
3366	-	"	-	-	- -	- - -	0.82	10.66	11.48	88.52
3368	-	"	-	-	- -	- - -	2.77	8.49	11.26	88.74
3370	-	"	-	-	- -	- - -	5.27	8 75	14 02	85.98
3372	-	"	-	-	- -	- - -	4.23	10.00	14.23	85 77
3374	-	"	-	-	- -	- - -	4.04	9.23	13 27	86.73
3376	-	"	-	-	- -	- - -	3.19	8.82	12.01	87.99
3378	-	"	-	-	- -	- - -	3.80	9 37	13.17	86.83
3380	-	"	-	-	- -	- - -	4.22	9.48	13.70	86.30
3382	-	"	-	-	- -	- - -	3.36	9.10	12.46	87 54
3384	-	"	-	-	- -	- - -	3 03	8.89	11.92	88.08
3386	-	"	-	-	- -	- - -	3.00	8.96	11.96	88.04

Class E — Continued.

Inspector's No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
3388	-	Littleton,	-	-	- -	- - -	3.63	9.27	12.90	87.10
3390	-	"	-	-	- -	- - -	3.72	9.30	13.02	86.98
3392	-	"	-	-	- -	- - -	3.92	9.65	13.57	86.43
3548	A.M.,	"	8	25 days,	Ayrshire and Durham,	4 qts. shorts, 2 qts. gluten,	2 79	10.17	12.96	87.04
3550	"	"	6	78 days,	Ayrshire and Jersey,	" "	3.61	10.05	13.66	86.34
3552	"	"	6	4½ mos.,	Ayrshire,	" "	3.22	9.67	12.89	87.11
3554	"	"	2½	28 days,	Ayrshire and Jersey,	" "	2.68	9.89	12.57	87.43
3556	"	"	4	7½ mos.,	Ayrshire,	" "	4.13	11.24	15.37	84.63
3558	"	"	6	5½ mos.,	"	" "	2.73	10.28	13.01	86.99
3560	"	"	4	78 days,	"	Shorts and middlings,	5.04	10.63	15.67	84.33
3562	"	"	6	6½ mos.,	"	" "	3.83	10.78	14.61	85.39
3564	"	"	Mix	ed milk,	"	" "	4.06	10.44	14.50	85.50
3566	"	"	5	7 days,	Durham,	" "	4.54	11.77	16.31	83.69
3964	P.M.,	Sherborn Reformatory,	10	8 mos.,	Ayrshire and Jersey,	Pasture and 4 qts. meal,	3.82	10.27	14.09	85.91
3966	"	" "	10	10 mos.,	" " "	" "	4.69	11.09	15.78	84.22
3968	"	" "	10	6 mos.,	Native,	" "	3.83	10.60	14.43	85.57
3970	"	" "	10	18 mos.,	"	" "	3.53	10.78	14.31	85.69
3972	"	" "	6	16 mos.,	"	" "	3.31	11.19	14 50	85.50

3974	"	" "	10	7 mos.,	Durham,	" "	4.06	10.11	14.17	85.83
3976	"	" "	6	5 mos.,	Ayrshire and Jersey,	" "	4.30	9.86	14.16	85.84
3978	"	" "	6	10 mos.,	Ayrshire and Native,	" "	3.01	10.39	13.40	86.60
3980	"	" "	12	4 mos.,	Native,	" "	3.87	10.52	14.39	85.61
3982	"	" "	6	3 mos.,	"	" "	3.10	10.14	13.24	86.76
3984	"	" "	7	3 mos.,	"	" "	2.21	10.25	12.46	87.54
3986	"	" "	Mixed	milk, 2	cows,	" "	3.86	10.31	14.17	85.83
-	A.M.,	Westborough,	-	-	Jersey (sick),	Pasture,	4.89	8.92	13.81	86.19
-	"	"	Mix	ture, sev	eral cows,	"	3.84	9.43	13.27	86.73
-	"	"	Mix	ture, 2	cows,	"	5.94	9.13	15.07	84.93
4815	"	Swansea,	3	4 mos.,	Holstein,	Middlings, shorts, corn stalks and green oats.	-	-	12.20	87.80
4817	"	"	2	5 mos.,	"	" "	3.43	8.92	12.35	87.65
4819	"	"	2	4 mos.,	"	" "	2.33	9.49	11.82	88.18
4821	"	"	2	4 mos.,	"	" "	1.96	8.38	10.34	89.66
4823	"	"	2	5½ mos.,	"	" "	3.13	9.54	12.67	87.33
4825	"	"	2	3 mos.,	"	" "	2.39	9.75	12.14	87.86
4827	"	"	6	3 mos.,	"	" "	3.27	8.67	11.94	88.06
4829	"	"	3	2½ mos.,	"	" "	3.46	9.09	12.55	87.45
4899	"	Hardwick,	10	4½ mos.,	"	Pasture,	3.36	8.73	12.09	87.91
4901	"	"	4	4 mos.,	"	"	3.26	8.93	12.19	87.81
4903	"	"	5	4 mos.,	"	"	3.70	9.35	13.05	86.95
5050	-	- - -	Mixed	milk of 30	cows, mostly natives.	- - -	3.13	9.93	13.06	86.94
5719	-	Warren,	-	-	- -	- - -	-	-	13.71	86.29

Class E — Continued.

Inspector's No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
5721	-	Warren,	-	-	- -	- - -	-	-	14.11	85.89
5723	-	"	-	-	- -	- - -	-	-	12.72	87.28
5725	-	"	-	-	- -	- - -	-	-	13.18	86.82
5727	-	"	-	-	- -	- - -	-	-	12.58	87.42
5729	-	"	-	-	- -	- - -	-	-	13.25	86.75
5731	-	"	-	-	- -	- - -	-	-	12.68	87.32
5733	-	"	-	-	- -	- - -	-	-	13.41	86.59
5735	-	"	-	-	- -	- - -	-	-	13.96	86.04
5737	-	"	-	-	- -	- - -	-	-	13.41	86.59
5739	-	"	-	-	- -	- - -	-	-	13.50	86.50
5741	-	"	-	-	- -	- - -	-	-	12.43	87.57
5743	-	"	-	-	- -	- - -	-	-	13.20	86.80
5745	-	"	-	-	- -	- - -	-	-	12.66	87.34
5747	-	"	-	-	- -	- - -	-	-	14.04	85.96
5749	-	"	-	-	- -	- - -	-	-	13.61	86.39
5751	-	"	-	-	- -	- - -	-	-	13.72	86.28
5773	P.M.,	Grafton,	7	2 mos.,	Grade Ayrshire,	Pasture, rowen, 6 qts. middlings.	3.26	9.32	12.58	87.42
5775	"	"	8	10 mos.,	Grade Jersey,	" "	5.64	10.43	16.07	83.93

5777	"	"	8	11 mos.,	" " . .	" "	2.09	11.36	13 45	86.55
5779	"	"	8	3½ mos.,	Grade Devon, . .	" "	1.49	10.59	12.08	87.92
5781	"	"	7	14 mos.,	Grade Jersey, . .	" "	4.21	10 21	14.42	85.58
5783	"	"	6	6 mos.,	Part Jersey, . .	Pasture, rowen, oats and corn,	2.30	10.91	13 21	86.79
5785	"	"	6	5 mos.,	Durham and Ayrshire,	" "	2.81	9 87	12.68	87.32
5791	"	"	2	1 mo.,	Part Jersey, . .	" "	3.31	10.16	13.47	86.53
6949	"	Lincoln, ...	Mixed	milk, 2	cows, ...	Shorts, meal and middlings,	4.57	10.57	15.14	84.86
6951	"	"	"	" 10	cows, ...	" "	3.11	10.39	13.50	86.50
6953	"	"	8	3 mos.,	Dutch, ...	" "	2.62	9.96	12.58	87.42
6955	"	"	Mixed	milk, 5	cows, ...	" "	3.38	10.04	13 42	86.58
6957	"	"	"	" 5	cows, ...	" "	4.48	9.65	14.13	85.87
6959	"	"	"	" 18	cows. Dutch, . .	" "	3.21	9.43	12.64	87.36
6937	"	"	8	2 mos.,	Ayrshire, . . .	Sprouts, meal and middlings,	2.66	9.11	11.77	88 23
6939	"	"	6 -	4 mos.,	Dutch, . . .	" "	2 67	8.90	11.57	88.43
6941	"	"	Mixed	milk, 3	cows, ...	" "	3.42	9 65	13.07	86.93
6943	"	"	"	" 3	cows, ...	" "	3 33	9.90	13.23	86.77
6945	"	"	"	" 3	cows, ...	Shorts, meal and middlings,	3.62	10.56	14 18	85.82
6947	"	"	8	6 mos.,	Durham and Ayrshire,	" "	4.48	10.73	15 21	84.79
6961	"	"	Mixed	milk, 28	cows, ...	" "	3 39	10.37	13 76	86.24
6963	"	"	"	" 9	cows, ...	" "	4.15	10.11	14.26	85.74
6399	"	Woburn, ...	3	6 mos.,	Native, ...	{ Shorts, hay and cotton-seed meal }	3.98	10.93	14.91	85.09
6401	"	"	8	8 mos.,	"	" "	4.24	10.22	14.46	85 54

Class E — Continued.

Inspector's No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
6403	P.M.,	Woburn,	6	6 mos.,	Ayrshire,	Shorts, hay and cotton-seed meal.	3.86	9.97	13.83	86 17
6405	"	"	Mixed	milk, 6	cows,	" "	4.18	10.37	14.55	85.45
6407	"	"	7	7 mos.,	Native,	" "	4.21	10.71	14.92	85.08
6409	"	"	8	6 mos.,	Durham,	Shorts, meal, hay and rowen,	4.82	10.46	15 28	84.72
6411	"	"	7	6 mos.,	Ayrshire,	" "	4.58	9.80	14.38	85.62
6413	"	"	8	6 mos.,	Native,	" "	1.88	9.83	11.71	88.29
6415	"	"	12	1 mo.,	Devon,	" "	2.68	10.55	13.23	86.77
6417	"	"	6	5 mos.,	Ayrshire and Durham,	" "	4.02	11.20	15.22	84.78
6419	"	"	8	2 mos.,	Durham,	" "	3.08	9.19	12.27	87.73
6421	"	"	6	4 mos.,	Ayrshire,	" "	3.28	10.48	13.76	86.24
6423	"	"	7	4 mos.,	Ayrshire and Durham,	" "	4 31	10.64	14.95	85.05
6425	"	"	7	4 mos.,	Native,	" "	3.84	9.88	13.72	86.28
6427	"	"	10	1½ mos.,	Durham,	" "	3.63	9.37	13.00	87.00
6429	"	"	Mixed	milk, 20	cows,	" "	3.35	9.96	13.31	86.69
6420	"	Chelmsford,	12	3½ mos.,	Dutch,	Turnips, potatoes, cotton-seed meal and shorts.	2.01	8.63	10.64	89.36
6422	"	"	10	2½ mos.,	"	" "	1.60	8.36	9.96	90.04
6424	"	"	8	4½ mos.,	Native,	" "	2.81	9.67	12 48	87.52
6426	"	"	10	4 mos.,	Ayrshire,	" "	2.72	8.30	11.02	88.98

6428	"	"	Mixed	milk,	4 cows,	" "	2.31	8.65	10.96	89.04
6461	"	Lincoln,	"	"	7 cows,	Meal, sprouts and corn fodder,	-	-	13.30	86.70
6463	"	"	"	"	4 cows,	Meal and shorts,	-	-	14.31	85.69
6465	"	"	"	"	6 cows,	Meal, sprouts and corn fodder,	-	-	14 91	85.09
6467	"	Concord,	"	"	4 cows,	Shorts, meal and rowen,	-	-	12.39	87.61
6469	"	"	"	"	4 cows,	Meal, corn and cotton-seed meal.	-	-	14 91	85.09
6471	"	"	"	"	4 cows,	Rye meal, corn and turnip tops,	-	-	13.45	86.55
6473	"	"	"	"	4 cows,	Meal and brewers' grains,	-	-	13.07	86.93
6475	"	"	"	"	5 cows,	Shorts and meal,	-	-	14.01	85.99
6477	"	"	"	"	4 cows,	" "	-	-	12 68	87.32
6479	"	"	"	"	5 cows,	Meal, shorts and corn,	-	-	13.03	86.97
6481	"	"	"	"	3 cows,	Gluten, meal and shorts,	-	-	12.55	87.45
6483	"	"	"	"	9 cows,	Meal, middlings and green barley.	-	-	14.26	85.74
6485	"	"	"	"	6 cows,	Sprouts and meal,	-	-	13.42	86.58
6487	"	"	"	"	6 cows,	Meal, shorts and cotton seed,	-	-	12 64	87.36
6489	"	"	"	"	7 cows,	Gluten,	-	-	13.22	86.78
6491	"	"	"	"	6 cows,	Meal and shorts,	-	-	12.77	87.23
6669	"	School for Feeble-Minded at Medfield,	4	3 mos.,	Native,	Shorts, hay and meal,	3.30	8.75	12.05	87.95
6671	"	" " "	4	3 wks.,	"	" " "	3.58	9.19	12.77	87.23
6673	"	" " "	4	3 wks.,	"	" " "	3.14	9.15	12.29	87.71
6675	"	" " "	5	2 wks.,	"	" " "	3.23	9.46	12.69	87.31
6677	"	" " "	6	3 wks.,	"	" " "	1.92	9.03	10.95	89.05

Class E — Continued.

Inspector's No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
6679	P.M.,	School for Feeble-Minded at Medfield,	2	6 wks.,	Holstein, . . .	Shorts, hay and meal, . .	1.87	9.02	10.89	89.11
6681	"	" " "	3	6 mos.,	Native, ...	" " " . .	4.07	9.24	13 31	86.69
6683	"	" " "	5	5 mos ,	"	" " " . .	3.10	9.56	12.66	87.34
6687	"	Westborough, ...	6	4 mos.,	Durham, . . .	Hay, gluten, corn fodder, shorts and corn meal.	2 55	8.59	11.14	88.86
6689	"	"	2	4 mos.,	"	" "	2.53	9.67	12.20	87.80
6691	"	"	2	5 days,	"	" "	2.74	9.65	12.39	87 61
6693	"	"	2	2 mos.,	"	" "	2.88	9.35	12.23	87.77
6695	"	"	4	4 mos.,	"	" "	3.02	10 52	13 54	86.46
6697	"	"	2	3 mos.,	"	" "	3.74	10.92	14.66	85 34
6699		"	10	6 mos.,	"	" "	3.84	9.82	13.66	86.34
6701	"	"	8	5 mos.,	Ayrshire and Durham,	" "	3.77	9.98	13 75	86.25
6703	"	"	7	13 mos.,	Durham, . . .	" "	3.32	10.39	13.71	86 29
6705	"	"	2	4 mos.,	Grade, ...	" "	3.45	10.69	14.14	85.86
6707	"	"	14	2 mos.,	Durham and Holstein,	" "	3.22	9.42	12 64	87.36
6709	"	"	4	4 mos.,	Durham, . . .	" "	3.00	9.79	12 79	87.21
6711	"	"	4	1 mo.,	"	" "	2.66	9.00	11.66	88.34
6713	"	"	12	5 mos.,	"	" "	3.19	10 29	13.48	86.52
6715	"	"	Mixed	milk, 2	Jerseys, . . .	" "	4 10	9 56	13.66	86.34

6717	"	"	"	" 2	Holsteins, . . .	" "	2 56	9.13	11.69	88 31
6825	A.M.,	State work-house at Bridgewater, .	5	6 mos.,	Alderney, . . .	Meal, shorts, hay and roots,	3 97	9.53	13.50	86.50
6827	"	" " " .	10	6 mos.,	Ayrshire, . . .	" "	4.49	10.71	15.20	84.80
6829	"	" " " .	3	3 mos.,	" . . .	" "	2.71	9.31	12.02	87.98
6831	"	" " " .	16	24 mos ,	" . . .	" "	3.00	9.85	12.85	87.15
6833	"	" " " .	8	6 mos.,	Alderney, . . .	" "	4.08	9.89	13.97	86.03
6835	"	" " " .	14	8 mos.,	Ayrshire, . . .	" "	3.51	9.92	13.43	86.57
6837	-	" " " .	9	3 mos.,	" . . .	" "	2.89	8.37	11.26	88.74
6839	-	" " " .	16	12 mos.,	" . . .	" "	2.80	9.08	11 88	88.12
6841	-	" " " .	3	5 mos.,	Jersey and Swiss, .	" "	3.90	9.81	13.71	86.29
6843	-	" " " .	7	2 mos.,	Ayrshire, . . .	" "	2.44	9.67	12.11	87.89
6845	-	" " " .	12	10 mos.,	" . . .	" "	2.20	9.21	11.41	88.59
6847	-	" " " .	8	3 mos.,	Jersey, ...	" "	4.36	9.65	14 01	85.99
6849	-	" " " .	10	3 mos.,	Ayrshire, . . .	" "	3.07	9.31	12 38	87.62
6851	-	" " " .	3	4 mos.,	" . . .	" "	3.09	9.66	12.75	87.25
6853	-	" " " .	3	3 mos.,	Swiss and Ayrshire, .	" "	2.35	9.17	11.52	88.48
6855	-	" " " .	3	3 mos.,	Ayrshire, . . .	" "	2.83	8.84	11.67	88.33
7055	P.M.,	Weston, ...	5	12 mos.,	Native, ...	100 parts of corn meal and 80 parts of malt sprouts; 10 qts. of the mixture to each cow daily, with swall hay and straw.	5.79	10.56	16.35	83.65
7057	-	"	7	3 mos.,	"		4.03	9.93	13.96	86.04
7059	-	"	7	10 mos.,	"		4.32	9.99	14.31	85.69
7061	-	"	6	12 mos.,	"		5.19	10.66	15.85	84.15
7063	-	"	5	3 mos.,	"		3.92	9.82	13.74	86.26

Class E — Concluded.

INSPECTOR'S No.	Time of Milking.	Where Obtained.	Age of Cow.	Time since Calving.	Breed.	Feed.	Fat.	Solids, not Fat.	Total Solids.	Water.
7065	-	Weston, ...	5	7 mos.,	Native, ...	100 parts of corn meal and 80 parts of malt sprouts; 10 qts. of the mixture to each cow daily, with swail hay and straw.	6.03	9.69	15.72	84.28
7067	-	"	12	3 mos.,	"		4.42	9.76	14.18	85.82
7069	-	"	Mixed	milk, 7	cows, ...		4.34	10.10	14.44	85.56

SUMMARY.

SOURCE.	Samples above the standard.	Samples below the standard.	TOTAL.	Percentage of samples above the standard.
Boston,	59	59	118	50.00
Lowell,	108	81	189	57.14
Fall River,	91	34	125	72.80
Cambridge,	50	68	118	42.37
Salem,	49	38	87	56.32
Lawrence,	48	38	86	55.81
Somerville,	36	48	84	42.85
Gloucester,	42	22	64	65.62
Worcester,	34	26	60	56.56
Lynn,	25	27	52	48.08
Chelsea,	18	22	40	45.00
Malden,	14	23	37	37.84
New Bedford,	21	16	37	56.76
Fitchburg,	20	10	30	66.67
Newburyport,	16	11	27	59.26
Haverhill,	18	8	26	69.23
Brockton,	19	5	24	79.16
Waltham,	8	7	15	53.33
Taunton,	6	2	8	75.00
Newton,	5	3	8	62.50
30 Towns,	218	137	355	61.41
Suspected producers,	125	120	245	51.02
Unknown,	9	4	13	69.23
Known purity,	105	71	176	60.00
Total,	1,144	880	2,024	56.22

CHARLES HARRINGTON, M. D.

PROF. GOESSMANN'S REPORT.

WESTERN MASSACHUSETTS.

The following report embraces the results of the analysis and inspection of milk obtained in the four western counties of Massachusetts. The samples of milk thus obtained were submitted to analysis at Amherst, under the direction of Prof. Chas. A. Goessmann, Analyst of the Board.

Collections of milk were made in the following cities and towns in Berkshire, Franklin, Hampden and Hampshire counties, the report covering the period from March 31, 1885, to May 31, 1886: — Adams, North Adams, Amherst, Chicopee, Greenfield, Holyoke, Northampton, Pittsfield, Springfield, Turner's Falls, Ware and Westfield.

The whole number of samples obtained was two hundred and eighty-one. These may be classified as follows: —

Whole number of samples collected,	281
" " submitted to analysis,	123
" " passed on inspection, being above the required standard of solids,	158
" " below required standard,	49
" " above " "	232

Thus 82 per cent. of the samples collected were above the required standard, while in the previous year 66 per cent. only of those collected in the same portions of the State, and nearly the same cities and towns, fulfilled the required conditions of quality; from which it appears, that considerable improvement has taken place in the western portion of State, in the quality of milk furnished to consumers.

The same measures have been employed with reference to warning notices, as have been observed in Eastern Massachusetts.

Of the samples found to fall below the requirement, —

There were having between	12½ and 13 per cent. of solids,	18
" " "	12 and 12½ " "	10
" " "	11 and 12 " "	13
" " "	10 and 11 " "	2
" " "	9 and 10 " "	6
Total,		49

All of these having less than 10 per cent. of total solids were undoubted samples of skimmed milk, and, in nearly every instance, were sold as such,—a fact which increases the percentage of milk above the required standard, since these should not be reckoned among that class, the present law providing for the sale of skimmed milk properly labelled.

Springfield.

Number of samples,	49
" above standard,	2
" below standard,	7
Lowest,	11.23

Inspector's Number.	Result of Analysis.					
	Temperature	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
3273,	11	1.0332	4.06	9.17	13.23	86.77
3281,	9	1.0336	4.59	9.02	13.61	86.39
3285,	9	1.0326	3.80	8.64	12.44	87.56
3287,	9	1.0316	3.07	8 55	11.62	88.38
3291,	9	1.0312	6.97	8.75	15.72	84.28
6321,	17	1.0332	3 99	9.31	13.30	86.70
6331,	18	1.0320	4 80	9.41	14.21	85.79
6337,	18	1.0296	3.56	8.58	12.14	87.86
6343,	18	1.0338	4 15	9 74	13.89	86.11
6347,	18	1.0260	9.52	8.47	17.99	82.01
6539,	18	1.0296	6.93	9 12	16.05	83 95
6545,	18	1.0350	2 34	9.24	11 58	88.42
6549,	18	1.0206	14.26	9.09	23.35	76.65
6553,	18	1.0302	5.05	8.82	13.87	86.13
6559,	18	1.0338	4.05	9.51	13.56	86.44
7147,	12	1.035	3.85	9.39	13.24	86 76
7149,	12	1.032	3.74	8.99	12 73	87.27
7153,	12	1.0314	3.61	7.62	11.23	88.77
7157,	14	1.0308	3.58	8.22	11.80	88.20
7161,	12	2.0344	4.14	9.43	13.57	86.43
7165,	14	1·0332	5.60	10.35	15.95	84.05

HOLYOKE.

Number of samples,	69
" above standard,	53
" below standard,	16
Lowest (not skimmed milk),	11.35

INSPECTOR'S NUMBER.	RESULT OF ANALYSIS.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
4369,	22	1.0296	5.53	8.68	14.21	85.79
4377,	21	1.0290	4.86	6.54	11.40	88.60
4379,	21	1.0290	4.94	8.94	13.88	86.12
4391,	22	1.0290	4.19	7.16	11.35	88.65
4395,	22	1.0320	4.07	9.36	13.43	86.57
4397,	22	1,0296	4 22	8.90	13.12	86.88
7423,	11	1.0326	4.10	8.50	12.60	87.40
7425,	11	1.0320	4.06	9.60	13.66	86.34
5793,	18	1 0305	4.58	9.85	13.43	86.57
5795,	18	1.0302	3 39	10 25	13.64	86.36
5809,	18	1·0302	.121	9.099	9.22	90.78*
5813,	19	1.0302	4.56	9.22	13.78	86.22
5817,	19	1.0302	4.71	9.09	13.80	86.20
7405,	11	1.0326	3.88	8.73	12.61	87.39
7409,	11	1.0332	3.92	8.69	12.61	87.39
7415,	11	1.0368	0.64	9.43	10.07	89.93*
7417,	11	1.038	0.54	9.29	9.83	- *
7883,	11	1.0350	4.18	9.30	13.48	86.52
7887,	11	1.0338	4.16	8.83	12.99	87.01
7635,	12.5	1.0335	4.20	9.34	13.54	86.46
7639,	15	1.0332	3 82	9.14	12.96	87.04
7645,	13	1.0344	3.57	8.39	11.96	88.04
7647,	13	1.0338	3.78	8.40	12.18	87.82
7649,	13	1.035	4.16	9 40	13.56	86.44
7651,	13	1 0374	0.32	9.29	9.61	90.39*
7895,	11	1 0344	3.96	9.28	13.24	86.76
7897,	11	1.0344	4.44	9.07	13.51	86.49
7899,	11	1.0322	3.69	8.55	12.24	87.7
7903,	11	1.0368	3.18	9.60	12.78	87.

* Skimmed milk.

Chicopee.

Number of samples, ... 27
" above standard, ... 21
" below standard, ... 6

Inspector's Number.	Result of Analysis. Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
4707, ...	25	1.0272	3.34	8.58	11.92	88.08
4709, ...	25	1.0284	3.70	8.83	12.53	87 47
4713, ...	25	1.0316	3 83	9.68	13.51	86.49
4715, ...	25	1.0284	3.38	8.70	12.08	87.92
4719, ...	24	1.0314	0.81	8.55	9.36	90.64*
4721, ...	24	1.0158	4.50	5.46	9.96	90.04
8743, ...	22	1.0278	3.88	8.54	12.42	87.58
8747, ...	22	1 0296	2.61	8.58	11.19	88.81
8759, ...	23	1.0290	3.53	10.01	13.54	86.46
8767, ...	23	1.0320	4.34	9.22	13.56	86.44
8769, ...	23	1.0308	4.33	9.03	13.36	86.64

North Adams.

Number of samples, ... 28
" above standard, ... 23
" below standard, ... 5
Lowest, ... 12.45

Inspector's Number.	Result of Analysis. Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
4613, ...	27	1.0281	4.33	8.64	12.97	87.03
4617, ...	27	1.0290	3.72	9.11	12.83	87.17
4619, ...	28	1.0278	4.66	9.29	13.95	86.05
4625, ...	28	1.0280	4.37	9.03	13 40	86.60
4629, ...	28	1.0290	3.79	9.11	12 90	87.10
4633, ...	27	1.0284	4.53	8.90	13.43	86.57
8309, ...	15	1.0362	4.76	9.93	14 69	85.31
8311, ...	14	1.0332	3.84	9.02	12.86	87.14
8323, ...	16	1.032	5.12	8.76	13.88	86.12
8329, ...	16	1.0314	3.63	9.38	13.00	86.99
8337, ...	16	1.0329	3.63	8.82	12 45	87.55

* Skimmed milk.

AMHERST.

Number of samples,	5
" above standard,	5
" below standard,	0
Lowest,	13.47

INSPECTOR'S NUMBER.	RESULT OF ANALYSIS.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
6721,	18	1.0320	5.28	9.16	14.44	85.56
6723,	18	1.0326	5.69	9.57	15.26	84.74
6725,	18	1.0320	5.17	9.45	14.62	85.38
6727,	18	1.0320	4.86	9.27	14.13	85 87
6729,	18	1.0338	4.04	9.43	13.47	86.53

NORTHAMPTON.

Number of samples,	17
" above standard,	16
" below standard,	1
Lowest,	12.80

INSPECTOR'S NUMBER.	RESULT OF ANALYSIS.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
3267,	11	1.0332	3.54	8 26	13.80	87.20
8505,	11	1.0326	4.90	8.58	13.48	86.52
8511,	11	1.0320	6.33	8.95	15.28	84 72
8513,	11	1.0326	4.83	8.97	13.80	86.20
8517,	11	1.0308	7.91	8.75	16.66	83.34
8521,	11	1.0356	4.60	9.84	14.44	85.56

Pittsfield.

Number of samples, ... 26
" above standard, ... 22
" below standard, ... 4
Lowest, ... 11.24

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity	Fat.	Solids, not Fat.	Total Solids.	Water.
4181,	21	1.0296	4.11	9.03	13.14	86.86
4187,	22	1.0296	4.35	8.94	13.29	86.71
4191,	22	1 0302	3.12	8.84	11.96	88.04
4195,	22	1.0296	4.54	9.22	13.76	86.24
4197,	22	1.0290	4.92	9 34	14.26	85.74
4199,	22	1.0296	4.21	9.42	13.63	86 37
6137,	21	1.0290	3.73	8.92	12.65	87.35
6143,	21	1.0302	4.58	9.40	13.98	87.02
6131,	21	1.0296	5.05	9.54	14.59	85.41
6135,	21	1.0296	3.93	8.93	12,86	87.14
6145,	-	1.0290	2.85	8 39	11.24	88.76
6149,	-	1 0296	5.09	9.26	14.35	85.65

Greenfield.

Number of samples, ... 8
" above standard, ... 6
" below Standard, ... 2

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C					
4003,	24	1.0290	4.89	9.12	14.01	85.99
4005,	24	1.0302	4 66	9.36	14.02	85.98
3993,	22	1 0308	4.33	9.53	13.86	86 14
3997,	22	1.0368	0.70	9.82	10 52	89.48*
3999,	22	1.0305	3.54	8.89	12.43	87.57

* Skimmed milk.

Westfield.

Number of samples, ... 19
" above standard, ... 16
" below standard, ... 3
Lowest (not skimmed milk), ... 12.54

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
8091, ...	16	1.0332	3.96	9.22	13.18	86.82
8093, ...	17	1.0329	3.60	8 94	12.54	87.46
8071, ...	14	1.0395	0.88	10.16	11.04	88.96*
8075, ...	14	1.0356	3.74	9 44	13.18	86.82
8079, ...	14	1.0335	3.94	10.00	13.94	86.06
8081, ...	14	1.0335	4.03	9.06	13.09	86.91
3751, ...	17	1.0320	3 93	9.25	13.18	86 82
3755, ...	16	1.0320	4.60	9.54	14 14	85.86
3757, ...	16	1.0308	3.86	8.72	12.58	87.42

Adams.

Number of samples, ... 5
" above standard, ... 2
" below standard, ... 3
Lowest, ... 12.39

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
6975, ...	14	1.0320	3.51	8.98	12.49	87.57
6977, ...	14	1.0278	4.75	8 10	12.85	87.15
6979, ...	14	1.0284	4.33	8.75	13.08	86 92
6981, ...	14	1.0326	4.42	8.93	13.35	86.65
6983, ...	-	1.0326	3 38	9.01	12.39	87.61

* Skimmed milk.

Turner's Falls.

Number of samples, ... 15
" above standard, ... 14
" below standard, ... 1

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
8945, ...	18	1.0302	5.08	8.89	13.97	86.03
8951, ...	18	1.0302	5.78	9.41	15.19	86.81
8959, ...	18	1.0302	4.36	8.74	13.10	86 90
8967, ...	18	1.0332	3.74	9.46	13.20	86.80

Ware.

Number of samples, ... 9
" above standard, ... 8
" below standard, ... 1

Inspector's Number.	Result of Analysis.					
	Temperature.	Specific Gravity.	Fat.	Solids, not Fat.	Total Solids.	Water.
	C.					
4485, ...	20	1.0320	3.61	9.68	13.29	86.71
4491, ...	20	1.0311	3.82	9.23	13.05	86.95
4493, ...	20	1.0302	3.98	9.07	13.05	86.95
4499, ...	20	1.0344	0.47	9.16	9.63	90.37*

* Skimmed milk.

C. A. GOESSMANN.

Amherst, Mass., Sept. 6, 1886.

REPORT OF THE ANALYST OF DRUGS.

Prof. Bennett F. Davenport, M. D.

REPORT OF THE ANALYST OF DRUGS.

BOSTON, May 31, 1886.

To S. W. ABBOTT, M. D.,
Health Officer of the State Board of Health, Lunacy and Charity.

SIR: — I have the honor to make the following report upon the drugs which have been submitted to me for examination since January 1, 1885: —

I have received 1,204 samples of pharmacopœial drugs, and have examined them as to their conformity to the standards prescribed by the statute. Although 538 of the samples, that is, 44.6 per cent., did not fairly conform to the standard, yet this cannot justly be considered as indicating that any such large proportion of all the drugs sold in this State is not of proper quality. For, only such drugs as were, upon good grounds, already suspected of being specially liable to be below the required standard of quality, were largely collected by the inspectors for the analyst. Therefore this large percentage represents the proportion of those which being already on trial, as it were, under suspicion, were found to be really below standard. In other States of the Union, judging from the character of sophistication occasionally reported as found there, this percentage would probably have been found to be still larger, and often of a much more gross nature. Certainly no fraud has been found quite equal to that cure-all "Kaskine, a non-secret remedy," which has been manufactured and sold in New York city, at the price of one dollar each, in small flat green-glass vials, containing about two-thirds of an ounce of a white granular powder, freely soluble in water, of a sweet taste, and without odor. The label claims that "Kaskine stands unequalled and unrivalled in the world of science as

the only medicine that can destroy the germs that cause each particular disease, and restore perfect health." Yet, upon analysis, it proves to be simple granular sugar, and nothing more.

Besides these 1,204 samples of pharmacopœial drugs, I have received and examined for the presence of lead, or the other commonly considered poisonous metals, 30 samples of cosmetics for the face and hair. Twelve of them, or 40 per cent., contained lead in amounts equivalent to from 0.22 to 2.32 per cent. of lead acetate. (See Appendix B.)

I have also received and examined 20 samples of so-called "Opium Habit Cures" for the presence of morphine, the chief active principle of opium. These included all the principal cures advertised throughout the States. They all responded to the principal tests for the presence of morphine, except one, which was labelled a "Double Chloride of Gold Cure," and this one failed to yield any reaction for the minutest trace of gold. (See Appendix C.)

Further details concerning my examination of these non-officinal preparations will be given in a later part of this report.

The following are the groups of drugs and the results of their examination: —

Alcohol, 9 samples. All about of standard quality as to their alcoholic strength, and of fair quality otherwise, yet having been stored in barrels as usually prepared they were unable to withstand the pharmacopœial tests for the absence of organic impurity.

Chloroform, 2 samples. Both proved to be but the crude drug.

Bismuth Subnitrate, 4 samples. All had retained an excessive amount of arsenical impurity.

Ferric Chloride Tinct., 3 samples. All had an excess of nitrate and of oxychloride.

Glycerine, 3 samples. All were of standard quality.

Iodine Tinct., 5 samples. Two only were of full standard strength.

Lead Salts, 8 samples. All were of standard quality.

Magnesium Salts, 3 samples. All were of good quality.

Mercury Salts, 2 samples. Both of proper quality.

Potassium Bromide, 6 samples. All had the usual excess of alkali to be expected, as mentioned in my last report, in the opaque porcelain-like crystals, and also the accompanying moisture. All had the common impurity of an excess over the allowed 3 per cent. of chloride. The pharmacopœial limits in testing bromide for chloride are more narrow than are commonly recognized. In the prescribed methods of testing, nine drops of the test solution, as run out of an ordinary burette, covers the entire range of variability between a strictly pure chemical and the salt which is to be excluded from pharmacopœial use by reason of the undue amount of chloride contained therein. The limits of the British and German pharmacopœias are even more strict than that of the United States Pharmacopœia. The following is a simple method for calculating the percentage of chloride impurity present according to the United States Pharmacopœial test, when it has already been determined that there is no iodide present: Subtract 25.03 from the number of cc. of the Silver Solution used in the test, divide the remainder by 0.1507 and the quotient is the percentage required.

Potassium Iodide, 42 samples. These all, as with the bromides, had an excess of alkali, with the accompanying moisture. They also all had some slight excess of chloride, the limits for which are even more strict than with the bromides. Nearly all of them contained some iodate, while bromate in the bromide salt was quite the exception.

Potassium Bitartrate, or Cream of Tartar, 34 samples. Of these 27, or 79.4 per cent., were fully up to the standard requirements. A very marked improvement over those reported upon last year.

Potassium Acetate, Citrate, Bicarbonate, Bichromate, Chlorate, Cyanide, Ferrocyanide, Nitrate, Permanganate, Sulphate and Sulphuret, with Potassium and Sodium Tartrate, 31 samples. All but 5 were of the standard quality.

Sodium Acetate, Borate, Bromide, Carbonate, Chloride, Phosphate, Salicylate, and Sulphate, 30 samples. All but 5 were of proper quality.

Soda, Chlorinated Solution, 2 samples. Both much below the standard.

Spirit, Ether Comp., 40 samples. Only 6, and all of these

labelled as made by Dr. Squibb of Brooklyn, were of standard quality. In all the others the Ethereal Oil, the principal ingredient, was absent.

Spirit, Nitrous Ether, 21 samples. The standard requires that this should contain not less than 4 per cent. of real Ethyl Nitrite. The samples were found to contain the following per cents. : —

0.04	0.19	0.26	0.52	0.73	0.73	0.83	0.93
0.96	1.10	1.19	1.29	1.50	1.82	2.00	2.20
2.34	2.36	2.50	2.85	3.74	-	-	-

Ethyl Nitrite is exceeding prone to decomposition, and to preserve the spirits the requirements of the pharmacopœia *must* be strictly observed. "Keep the product in *small*, glass-stoppered vials, in a dark place, remote from lights or fire." Otherwise, even if it has been properly made, it cannot long retain its pharmacopœial quality. It cannot be preserved in carboys, which have to be often opened before the spirit is all consumed. The method of assay given in the last edition of the British Pharmacopœia, and which utilizes the reaction with an acid solution of potassium iodide, and measures the volume of nitric oxide gas as generated in Allen's modification of Lunge's Azotometer, I have continued to use as giving the most satisfactory results of any method yet devised.

Sulphur, Precipitated, 12 samples. Of these 5 were of standard quality.

Zinc Salts, Acetate, Bromide, Chloride, Oxide and Sulphate, 20 samples. All of these were of fair standard quality.

Opium, Powdered, 63 samples. They, by the official method of assay, yielded the following percentages of morphine, by which 43 samples were below the minimum limit of 12 per cent. morphine : —

0.80	3 62	6.30	6.68	7.90	8.08	8.36	8.44	8.72	9.04
9.42	9.46	9.80	9.82	9.86	10.00	10.02	10.10	10.10	10.14
10.16	10.23	10.56	10.58	10.62	10.72	10.78	10.82	11.00	11.08
11.16	11.18	11.20	11.20	11.24	11.52	11.64	11.66	11 72	11.80
11 90	11.92	11.94	12.00	12.00	12.01	12.02	12.06	12.12	12.18
12.24	12.26	12 28	12.28	12.30	12.32	12.58	12.80	12.30	12.94
13.34	14.02	14.78	-	-	-	-	-	-	-

ium, Tinctures, 97 samples. These assayed by the same ›ds as the opium powder yielded the following per- ;e of morphine. Of these, 62 samples fell below the ırd minimum limit of 1.20 per cent. of morphine : —

0.01	0.14	0.17	0.36	0.55	0.62	0.64	0.65	0.65
0.72	0.72	0.72	0.75	0.75	0.76	0.80	0.83	0 83
0.86	0.87	0.88	0.88	0.88	0.88	0.89	0 89	0.91
0.98	0.98	0.98	0.99	0.99	0.99	1.00	1.02	1.03
1.03	1.05	1.06	1.06	1.08	1.08	1.08	1.08	1.09
1.11	1.11	1.13	1.15	1.16	1.16	1.17	1.17	1.18
1 19	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
1.20	1.20	1.20	1.20	1.20	1.23	1.20	1.20	1.23
1.26	1.27	1.28	1.28	1.29	1.30	1.31	1.31	1.34
1.37	1.37	1.41	1.41	1.42	1.62	-	-	-

um Tinctures, Camphorated, 9 samples. All but three ·ed to be the standard preparation. To these liquorice her coloring material had been added.

um and Ipecac Powder, Dover's, 19 samples. All he officinal preparation except in one case, where the ›mponent sodium sulphate was still used, not having eplaced by the milk sugar at present required.

·phine Comp. Powder, 1 sample. This was of standard y.

·phine Salts, Acetate and Sulphate, 8 samples. All of were of the standard quality.

:hona, Powdered, 6 samples. These, by the officinal d of assay, yielded the following percentages of total ids, and therefore 4 of them fell below the standard um limit of 3 per cent.

1.17	1.67	2.0	2.72	3.85	6.50

:hona Alkaloids Salts of the United States Pharma- ı, 73 samples. Of these, 20 samples either contained ·essive amount of a cheaper member of the four officinal na alkaloids, or else was a more common salt substi- for a less common one.

ı and Quinine Citrate, in scales, 24 samples. Almost them were the unofficinal preparation containing am- . Only 4 of them yielded the standard quantity of r cent. of quinine alkaloid. They by the officinal

method of assay yielded the following percentages of alkaloid: —

4.2	4.40	7.75	8.88	8.95	8.95	9.85	9.88	9.92	10.13	
18.20	10.25	10.40	10.50	10.98	11.10	11.30	11.50	11.55	11.85	
12.00	12.25	12.40	12.46	-	-	-	-	-	-	-

Iron and Quinine Citrate, Solution, 6 samples. Of these but one yielded the standard amount of 6 per cent. of alkaloid. They upon analysis yielded the following percentages of alkaloid: —

0.37	0.46	0.76	1.75	2.21	7.0

Strychnine, Salts, 3 samples. All were of standard quality.

Sugar, Cane and Milk, 8 samples. All were fairly standard quality, except one of the cane sugars which contained sufficient ultra marine to be rendered distinctly blue thereby, and two samples of the milk sugars, which had not been properly purified from other organic matter.

Syrups, 22 samples. All have conformed to the standard requirements except 2, which were about 10 per cent. deficient in the sugar.

Honeys, 3 samples of the clarified. Not one of them was of standard quality, as all contained glucose admixture.

Atropine Sulphate, Salicin, Thymol, Veratrine, Vinegar, Ammonium Chloride, Sulphur Iodide, 1 sample of each, and of Carbo Animalis, Santonin, 2 samples of each. All proved to be of good standard quality.

Cinnamon, Powdered, 3 samples. Of which 2 contained admixture of corn flour.

Cochineal, 3 samples. Of which 2 were loaded with heavy foreign powder.

Crocus, 3 samples. Of which all were really safflower.

Ergot, Fluid Ext., 2 samples. All of good quality.

Jalap, 22 samples. Of these 8 were up to the standard required of not less than 12 per cent. of total resin, of which not over 10 per cent. is soluble in ether. The percentage of total resin, and of that soluble in ether, were as follows:

Sample No.	Per cent. of Soluble Resin.	Per cent. of Resin Soluble in Ether.
1, ...	0.18	0.02
2, ...	1.11	0.09
3, ...	4.20	0.94
4, ...	7.22	0.41

e No.	Per cent. of Soluble Resin.	Per cent of Resin Soluble in Ether.
. . . .	7.34	0.39
. . . .	8.05	0.9
. . . .	8.66	0.09
. . . .	9.15	1.10
. . . .	9.3	0.42
. . . .	9 3	1.03
. . . .	9.5	2.3
. . . .	10.03	0.26
. . . .	10.43	0 20
. . . .	11.91	0.50
. . . .	12.15	1.15
. . . .	12.39	0.4
. . . .	12.55	1.05
. . . .	13.2	1.03
. . . .	13.67	1.61
. . . .	15.2	0.9
. . . . . .	16.08	1.15
. . . .	18.5	1.9

usk, 2 samples. Of which both were largely adulterated foreign material.

ils, Fixed and Volatile, of the United States Pharmaco-, 183 samples have been examined. Of these 73 have ved not to be of the standard pharmacopœial quality. recent work by Dr. H. Hager, entitled "Chemische Re-nen zum Nachweise des Terpentinöls in den Aetherischen n, in Balsamen," etc., an abstract of which was pub-d in the November, 1885, number of "The American ggist," has been of very great assistance in the examina- of the volatile oils. I have likewise had the aid of sche Brothers of New York city, the American branch chimmel & Co. of Leipzig, probably the largest and best vn manufacturers and dealers in essential oils in the d, who have kindly furnished me with all the samples of of known purity that I desired as standards for compar-. The basis for Dr. Hager's system of examination de-s upon the changes of color induced in solutions of ac resin by the action of ozone, which oil of turpentine has been exposed to light and air always contains, that more or less rectified turpentine is the most com- adulterant of the essential oils.

psin, Saccharated, 5 samples. But 1 of them was of harmacopœial quality in digestive activity.

Resins of the United States Pharmacopœia, 19 samples. All were fairly of the standard quality.

Soaps, 4 samples. All of good quality.

Spirits, Brandy and Whiskey, 76 samples have been examined. In alcoholic strength they ranged from 42.8 to 62 per cent. by volume, and in residue from 0.08 to 1.80 per cent. The pharmacopœia, the standard, calls for the straight, natural distilled spirit from fermented grapes or grain, unchanged in any way except by time and storage in oak casks, and certainly not "rectified," or otherwise "improved." To these requirements but 9 of the samples conformed in any fair degree. For the sake of the public health, however, it is a cause for congratulation that the chief deviations from the requirements of the pharmacopœia consist almost exclusively in the addition of alcohol, of water, and of harmless sweetening and flavoring substances. Not a single sample of adulterated spirits in the popular understanding of that term, that is, one containing a more injurious ingredient than alcohol itself, was met with, although so very few were exactly what they purported to be.

In illustration of the true nature of brandy even before it has been exported from France, I will quote the following extracts from the work of M. M. Duplais, the well known high authority upon "Alcoholic Liquors": —

Receipts for Aging Brandies, and other Spirits; for Improving them, and for Imitating the Aroma and Flavor of Different Growths. — Everybody knows that the best distilled new brandies always retain a sharpness which causes them to be recognized at once, and that they are so much better as they become older. That to correct this sharpness, to age, and to imitate the aroma of different growths, certain precautions are to be used. We shall indicate below those which are most certain to succeed: —

Cutting or Mixing Common Brandies. — In the brandy trade they generally employ spirits of Montpellier, of beet, molasses, or grain, for the manufacture of common brandies, which are then labelled brandy of Montpellier, Armagnac, etc., according as the spirits have been mixed with low wines prepared for the purpose, or with some other preparation. The following are the different methods of preparing common brandies: *First Process.* — This consists in reducing alcohol to the requisite strength, and adding to the mixture three litres of molasses for 100 gallons of brandy. The molasses should be previously well mixed in the water intended for the cutting, with a sufficient quantity of good caramel to produce a golden-yellow tint. When the mix-

ing is finished, 0 02 litres of water of ammonia is to be added, and the whole vigorously stirred with a rummaging stick. *Second Process.*— In this the molasses is replaced by an equal quantity of syrup of raisins. *Third Process.*— This is like the second process, with the addition of two per cent. of common rum.

Method of imitating Cognac Brandy.—This of all brandies is the most difficult to imitate, and among the numerous preparations used for obtaining this end we have seen very few which so nearly approached success as the following:—

Take of	Alcohol of 85 per cent. (well flavored),	54 litres
	Rum of good quality,	2 "
	Syrup of raisins,	3 "
	Infusion of green walnut hulls,	2 "
	Infusion of the shells of bitter almonds,	2 "
	Catechu in powder,	15 grammes
	Balsam of Tolu,	6 "
	Pure water,	37 litres
	Product,	100 litres.

Mix and color with caramel of the best quality.

The object of using syrup of raisins or molasses and liquorice root is to soften and impart a smoothness to the brandy; the addition of rum, infusion of the hulls of bitter almonds, of tea, catechu, and balsam of Tolu, is to impart bouquet, delicacy and aroma. Infusion of walnut hulls gives the flavor of age; cream of tartar and boracic acid make a bead upon brandy of only 45 per cent. alcohol; liquorice root also has the same property. It is indispensable to use the water of ammonia in the proportion of 0.02 litre to the 100 litres when the brandy is sharp, or when it contains an acid, and in any event, whatever be the nature of the brandy, this small quantity of the alkali can do no possible injury to the quality of the spirit or to the health of the consumer.

Improving Brandies.—Generally the *genuine* new brandies of Montpellier, Armagnac, Cognac, and other districts, are improved in quality by adding to them 15 grammes of sugar candy, or 0.03 litres of the syrup of raisins to the litre, which removes their sharpness and renders them smoother and more agreeable. The flavor, the aroma, and the age of the brandies of Cognac, etc., may be increased by the addition of various substances. The following is a receipt for 100 litres of brandy:

Old rum,	2 litres
Old kirsch,	1.75 "
Infusion of green walnut hulls,	0.75 "
Syrup of raisins,	2 "

It is a fact worthy of note that the brandy obtained by the addition in limited proportions of a spirit foreign to the wine before it is distilled cannot be distinguished from the brandy resulting from the natural wine by itself; that is to say, without this addition. Finally brandy resulting from this method defies all methods of investigation. We may suspect

the mixture, and even know of its existence, but we cannot furnish the proof. Neither the most skilful and practised taste, nor the persevering researches of the most skilful and learned chemists have been able to detect it. M. Payen himself acknowledged, sometime since, that, in the present state of science, the discovery of this mixture presented insurmountable obstacles."

Wines, Red and White, 30 samples have been examined. In alcoholic strength they varied between 5 and 21.4 per cent. by weight, and in solid residues from 1.25 to 21.87 per cent. The pharmacopœia calls for the straight, natural "alcoholic liquid made by fermenting the unmodified juice of the grape." To this requirement of the United States Pharmacopœia but one sample out of the 30 conformed in any fair degree; yet, fortunately, as in the case of the spirits examined, alcohol has been the most injurious ingredient found present in the samples. About every sample had been fortified in alcohol and sweetened with sugar.

Wines, Medicated, such as Antimony, Bitter Wine of Iron, Colchicum and Ipecac, 16 samples were examined and found to be of fairly standard quality as such.

Tinctures, of the United States Pharmacopœia, exclusive of Opium, 30 samples were examined and all found to be of fairly standard quality, except in the case of 3 tinctures of Nux Vomica. Of these 2 had about 1 per cent. of solid extract, while 1 had 2.7 per cent., while they should have had exactly 2 per cent.

Taraxacum, 21 samples were examined and were found to be, in all cases but 2, nothing else than the chicory which in the drug trade of late years has become so generally substituted for it.

Unguents, of the United States Pharmacopœia, 10 samples were examined and all found to be of fairly standard quality.

Hyoscyamus, Jaborandi, Mace, Pepo., Red Rose, and Tamarind, 1 sample each was examined and found to be of fairly standard quality.

The following drugs in the form of powders have been examined: —

Acacia, 4 samples. All of standard quality.

Arrowroot, 14 samples. All of standard quality.

Capsicum, 2 samples. One of which had a considerable admixture of starch.

Ipecac, 3 samples. All of good quality.

Jalap, 4 samples. All deficient in resin.

Mustard, 30 samples. Half of them had admixtures of flour.

Pepper, 12 samples. Of which 6 contained foreign admixture.

Pimento, 10 samples. All of fair quality.

Podophyllum, 4 samples. All of fair quality.

Quassia, 2 samples. All of standard quality.

Rhubarb, 12 samples. All of fair quality.

Rumex, 3 samples. Of these 2 were of good quality.

Sanguinaria, Sassafras, Sarsaparilla, Uva Ursi, Xanthoxylum and Zingiber, 3 samples of each, All of good quality.

Sage, 4 samples. All of good quality.

Scilla, Senna, Stramonium and Tanacetum, 2 of each. All of good quality.

Pareira, Santalum, Sambucus, Savin, Scutellaria, Spigelia, Stillingia, Valerian, Vanilla and Veratum Viride, 1 of each. All were of good quality.

Respectfully submitted,

BENNETT F. DAVENPORT.

APPENDICES TO FOOD AND DRUG REPORT.

APPENDIX A.

EXAMINATION OF VINEGAR BY THE PRODUCER.

To the farmer or other manufacturer of cider vinegar it is a matter of considerable importance to know when the product is marketable, or, in other words, when it shall have acquired the requisite degree of acidity, which in this Commonwealth is equal to 4.50 per cent. of absolute acetic acid. In addition to the standard of acidity the statute fixes a minimum limit of residue, which, however, is of minor importance to the honest manufacturer, the requirement being made solely to prevent the substitution of the so-called white-wine vinegar, which, when colored by means of the usual agents, may very well pass for cider vinegar, but which, though equalling or surpassing the latter in acidity, yields on evaporation a much smaller amount of residue. The amount of the latter and the character of the ash are therefore of great assistance in detecting the admixture or substitution of the spurious article. The maker of genuine cider vinegar need concern himself only with the percentage of acidity, since the pure vinegar will yield the required residue. The employment of a professional chemist for the examination of vinegar involves more or less time and trouble, and considerable expense, so it would be of considerable advantage in many ways to the producer could he make his own examinations whenever necessary. A method for the determination of the acidity of vinegar which may be carried out by non-professional persons unused to manipulation of apparatus must necessarily be as simple as possible, easy of application, and involving no working of mathematical formulæ. The following is recommended as fulfilling these requirements: —

The only apparatus necessary are a cylindrical 50 cubic-centimeter graduate, divided by lines into 50 equal parts, a

glass rod, and a common tumbler, or white cup or mug. The graduate and rod can be obtained of any dealer in apparatus, or ordered through an apothecary; their cost is small. The only chemicals necessary are a half per cent. solution of rosolic acid or phenolthalein in dilute alcohol for use as an "indicator," and a deci-normal solution of caustic soda, which can be obtained through any good apothecary. Of the former an ounce or two, of the latter twenty to thirty ounces, may be ordered at a time.

Directions. — Pour into the graduate, which must be clean and dry, enough vinegar to fill to the line indicating six volumes,* add three or four times as much water and pour into the tumbler, underneath which is placed a piece of white paper, or into a white cup or mug. Rinse the graduate once or twice with water and add the rinsings to the rest. Then add a few drops of the "indicator" and stir with the glass rod. Next wipe the inside of the graduate as dry as possible with a bit of clean rag on a stick, and fill it up to the 50 mark with the soda solution. Now add the soda little by little from the graduate to the diluted vinegar, and stir the mixture on each addition with the rod. It will be noticed that as the soda solution mixes with the vinegar a pink color appears, which, up to a certain point in the operation, disappears on stirring. When the point is reached where the color persists, cease adding the soda, and observe how much is left in the graduate. This amount substracted from the original 50 shows how many volumes have been used. The number of volumes used, divided by 10, equals the percentage of acetic acid in the sample. The stronger the vinegar the greater the amount of soda necessary to cause the pink color, and *vice versâ*.

Examples. — On the persistent appearance of the pink color, 12 volumes are left in the graduate, showing that 38 volumes have been used. The acidity in this case would be 3.8. In the examination of another sample, five volumes are left, showing that 45 were required; the acidity is therefore 4.5.

* If by reason of absence of lines below the 10 mark (as is often the case) it is impossible to measure six volumes from the bottom, fill the graduate part way (say to the 20 mark) with water and then add enough vinegar to bring the whole to six volumes more.

If the whole of the contents of the graduate do not cause the change of color, it is unnecessary to go any further, for the acidity then exceeds five per cent.

CHARLES HARRINGTON.

APPENDIX B.

BOSTON, April 12, 1886.

S. W. ABBOTT, M. D., *Health Officer.*

DEAR SIR: — I herewith report upon samples of cosmetics which I have examined with special reference as to the presence of lead, or any other commonly considered poisonous metals. They were as follows: —

	Per cent. of lead acetate.
Ayer's Hair Vigor contained the equivalent of about . .	0.3
"Revivum" Hair Restorer . .	1.86
Mrs. S. A. Allen's Hair Restorer . .	2.3
American Hair Restorative . .	0.61
Barrett's Vegetable Hair Restorative . .	0.22
Chevalier's Life for the Hair . .	much.
Hall's Vegetable Sicilian Hair Renewer . .	1.75
Wood's Hair Restorative . .	1.59
Ring's Vegetable Ambrosia . .	1 51
Parker's Hair Balsam . .	2.32
Wolf's Vegetable Hair Restorer . .	0.95

Respectfully submitted,

B. F. DAVENPORT.

APPENDIX C.

APRIL 12, 1886.

S. W. ABBOTT, M. D., *Health Officer.*

DEAR SIR: — I have to report upon twenty samples of so-called opium cures which have been obtained from their proprietors. They have all been tested for the presence of morphine, and they have all responded to the usual reactions therefor, except the "Keeley's Double Chloride of Gold Cure." This one, however, gave no reaction for the presence of even a trace of gold therein.

The cures were all uniformly obtained as for one who had acquired the habit of taking the, for an opium-eater, ery moderate quantity of only one grain of morphine

per day. It was expected, as proved to be the case, that the cures for even such a mild case would contain enough morphine to furnish unmistakable evidence of its presence, if it contained any at all.

As the point sought to be ascertained was simply the presence or absence, in the opium cure itself, of the morphine, the active principle of the opium, the very thing for which it was offered as a cure, the several preparations were uniformly tested only in regard to this one particular, and not as to their other constituents.

The twenty varieties of cures were as follows: —

H. L. Baker, Toledo Ohio.
J. C. Beck, Cincinnati, Ohio.
Chas. C. Beers, New York City.
Geo. A. Bradford, Columbus, Ga.
P. B. Bowzer, Logansport, Ind.
J. S. Carleton, Chicago, Ill.
S. B. Collins, La Porte, Ind.
B. S. Dispensary, Berrien Spring, Mich.
J. A. Drollinger, La Porte, Ind.
J. R. A. Dunn, Elizabeth, N. J.
J. C. Hoffman, Jefferson, Wis.
H. H. Kane, New York City.
L. E. Keeley, Dwight, Ill.
F. E. Marsh, Quincy, Mich.
L. Meeker, Chicago, Ill.
Wm. P. Phelon, Chicago, Ill.
Salvo Remedy, New York City.
W. B. Squire, Worthington, Ind.
J. L. Stevens, Lebanon, Ohio.
B. M. Woolley, Atlanta, Ga.

I herewith furnish a collection of the circulars of the above twenty, and also of four others of whom I did not succeed in obtaining samples of the "cure."

Respectfully submitted,

B. F. DAVENPORT.

DISPOSAL OF SEWAGE

AT THE

MASSACHUSETTS REFORMATORY,

FORMERLY THE STATE PRISON AT CONCORD.

By William Wheeler, C. E.

DISPOSAL OF SEWAGE AT THE MASSACHUSETTS REFORMATORY.

BY WILLIAM WHEELER, C. E.

The disposal, by improved methods, of the sewage of the State Prison at Concord, Mass., was provided for by the General Court of 1883, by the passage of the following Act: —

[CHAP. 167, ACTS OF 1883.]

AN ACT providing for the Disposal of the Sewage of the State Prison.

Be it enacted, etc., as follows:

SECT. 1. The commissioners of prisons are authorized to expend a sum not exceeding five thousand dollars for the disposal of the sewage at the state prison at Concord, but no expenditure shall be made for such purpose, except for surveys and plans, until said plans shall be approved by the state board of health, lunacy and charity, and the sewage shall be disposed of in accordance with plans so approved. Said board of health, lunacy and charity may at any time, and upon the request of the selectmen of the town of Concord shall, examine the methods of disposing of said sewage and may direct that changes be made in said methods and said commissioners shall make said changes, and the cost thereof shall be paid from the annual appropriation for the expenses of said institution.

SECT. 2. Chapter ten of the acts of the year eighteen hundred and seventy-eight, chapter sixty-five of the resolves of the year eighteen hundred and eighty-one and so much of chapter sixty of the resolves of the year eighteen hundred and eighty-two as authorizes the expenditure of three thousand dollars for the disposal of said sewage are hereby repealed.

SECT. 3. This act shall take effect upon its passage. [*Approved May 5, 1883.*

Prior to the passage of this Act, the sewage from the State Prison and adjoining State property at Concord, was disposed of by a variety of methods, or rather a combination

of expedients, conspicuously lacking in method as well as in simplicity of management, and in the requirements of modern sanitation, as will appear from the following outline of the drainage works as they then were: —

The sewage from the main group of prison buildings and the brick workshops,—amounting to upwards of 100,000 gallons per day,—together with the roof water from the same buildings, was originally carried by the lateral drains into large unventilated brick sewers, through which it was discharged in its crude state into the Assabet River, at a point about two hundred and fifty feet above the Elm Street Bridge.

The main sewer, into which emptied all the drains of the main prison, and the Warden's and Deputy Warden's houses, was laid at a considerable declivity from the east wing to the point of discharge into the river, below the level of low water surface. Another brick sewer, leading from the east end of the "strong rooms," and receiving the entire drainage of the gas-works, laundry, kitchen, and brick shops, entered the main sewer at a point about one hundred and sixty feet from the east wing.

Subsequently a large subterranean screen-pit, fitted with coarse wire screens, had been constructed near the line of the main sewer, just below the junction of the one leading from the "strong rooms," and connections made through which the whole of the crude sewage could be turned into the screen-pit, where the solid portions would be retained by the screens, and the liquid portion be then returned into the main sewer. It was the apparent purpose of this contrivance to exclude from the river such floating and suspended sewage matter as had previously begun to gather along its banks and in foul deposits upon its shoal bottom, to the growing alarm and inconvenience of those who lived near, or frequented the stream below the point of discharge.

The liquid portion of the sewage, with all its soluble constituents and much of the finer suspended matter,—containing, indeed, the greater part of the noxious ingredients thereof,—was discharged, as before, into the river, in undiminished volume; while the inconvenience of removing the d portion through the small man-holes of the screen-pit,

producing temporarily a positive nuisance, and the necessity of providing a freer course for the sewage in time of storm, subjected the operators of the works to two phases of temptation, which were apparently irresistible. These were: *first*, the opening of the gates of the main sewer, so that the whole sewage would pass around the screen-pit directly into the stream; and, *second*, the greater evil of raising the screen, and allowing the accumulations of weeks or even months of putrescent solids, or sludge, to be flushed out of the screen-pit *en masse* into the river, by the storm-flow, thus worse than undoing the work which the screen-pits were designed to accomplish.

Within the prison, each cell is provided with a water-closet and set bowl, and a group of four cells upon each of five floors, comprising a total of twenty cells, is served by a single soil pipe. Such an abundance of sewer connections within living-rooms of so narrow compass could be safely tolerated only with the assurance of the most perfect plumbing, and a rational and positive system of ventilation. Primarily, the second of these conditions can hardly be said to have been provided, inasmuch as each soil pipe orginally opened up into the partially ventilated attic or garret over the cells where all the ordinary ventilation pipes of the cells also opened,— soil and ventilation pipes being carried up together within the cell walls, and their open tops terminating at the same level. This defect had been corrected in the three wings of the main prison, by extending the soil pipes through the roof after uniting four or six of them in one large pipe. In the "strong rooms," however, no change in the original plan of ventilation had been made.

The waste water from the gas-works, originally discharged into the common drains, had been afterwards excluded therefrom, and allowed to run into an open sink-hole, in the free dry gravel in the rear of the buildings,— its pungent odor seeming to defy the attempts made to confine it within sewer limits, and making its escape through the conductors in the vicinity of the kitchen and "strong rooms."

A portion of the roof conductors had also been disconnected from the drains in order to cut off ways by which sewer gases might escape near the upper windows of the

main prison, particularly around the hospital. The extension of the soil pipes of the cells through the roof, as above described, seemed to have aided in obviating this danger.

The drainage from the sinks and water-closets of the isolated wooden shop, formerly used in the manufacture of picture moulding (but since removed), had found its only outlet in an unsightly and unsavory sink-hole, some seventy feet back of the shop, into which it flowed through an open ditch.

A large quantity of liquid refuse, distinct from any above described, flowed from the dyeing and washing vats used in the hat shops. The amount of this was from 40,000 to 70,000 gallons per day, and, as its impurities comprised only felting fibre and dye stuffs, — harmless from a sanitary point of view, — it had been allowed to flow out upon the surface of the ground and into pits from which mortar-sand and gravel had been taken, and left to soak away as best it might. Unsightly to look upon, covering, as it did, half an acre of ground at times, and destroying whatever grass or other vegetation it came in contact with, it was desirable to devise a more acceptable means of disposing of this matter also.

Finally, the sink drainage from the ten double tenements upon Commonwealth Row, so-called, occupied by officers and their families, was collected by a pipe sewer, which discharged into a large brick cesspool. This sewer was constructed at so flat a grade that the scanty flow from the sink drains alone was insufficient to keep it clear, and frequent recourse to other means, such as drawing a follower or plunger through it, had to be resorted to. The cesspool itself, although situated at sufficient elevation to render its discharge by means of a flushing siphon practicable, was not constructed with that end in view, and consequently its contents had to be removed entirely by pumping at intervals of a week or less, through the man-hole, by manual labor. This involved the labor of about six men, half a day each week, or a total expenditure of six months' labor for one man throughout the year. All fœcal matter was disposed of through common isolated privies, one being

provided for each tenement, water-closets not having been introduced into the tenements at that time.

Such were the somewhat heterogeneous provisions for drainage which had obtained, through frequent changes and modifications, up to the passage of the Act of May, 1883, — unsanitary in conception, ineffectual in operation, in scope limited, in plan and method various, expensive in maintenance under their proper working, and wasteful of fertilizing constituents, in the midst of State lands combining both the need and opportunity for their utilization thereon.

Having received instructions from the Prison Commissioners, in the following June, to prepare a comprehensive plan for an improved system of sewerage, to be built under the provisions of the Act of 1883, examinations and surveys were first made to determine the general conditions of the problem, — especially the nature and quantity of the various kinds of refuse to be disposed of, the dimensions and grades of the old drains as affecting their adaptability to a new system, the topography of the adjacent land of the Commonwealth and the nature of its soil, as affording opportunity for the distribution and utilization of sewage thereon, and the liability of such use of the land to impair the driven wells from which the prison then obtained a large part of its water supply.

On the 16th of August following, a plan of the projected works was submitted to the commissioners, and, after acceptance by them, was referred to the State Board of Health, Lunacy and Charity, by whom, after some changes in the selection of lands upon which the sewage was to be disposed of, it was duly approved, September 1st, 1883.

The construction of the works was begun upon the eighteenth day of the same month, and, exclusive of the connection of the warden's, deputy-warden's and officers' houses, and a few minor details, was completed early in the following summer, — work having been suspended during the intervening winter and spring by reason of the unfitness of the season and the inadequacy of the original appropriation.

All of the common labor, and much of the skilled work, was done by convicts, who were employed at wages agreed upon with the warden.

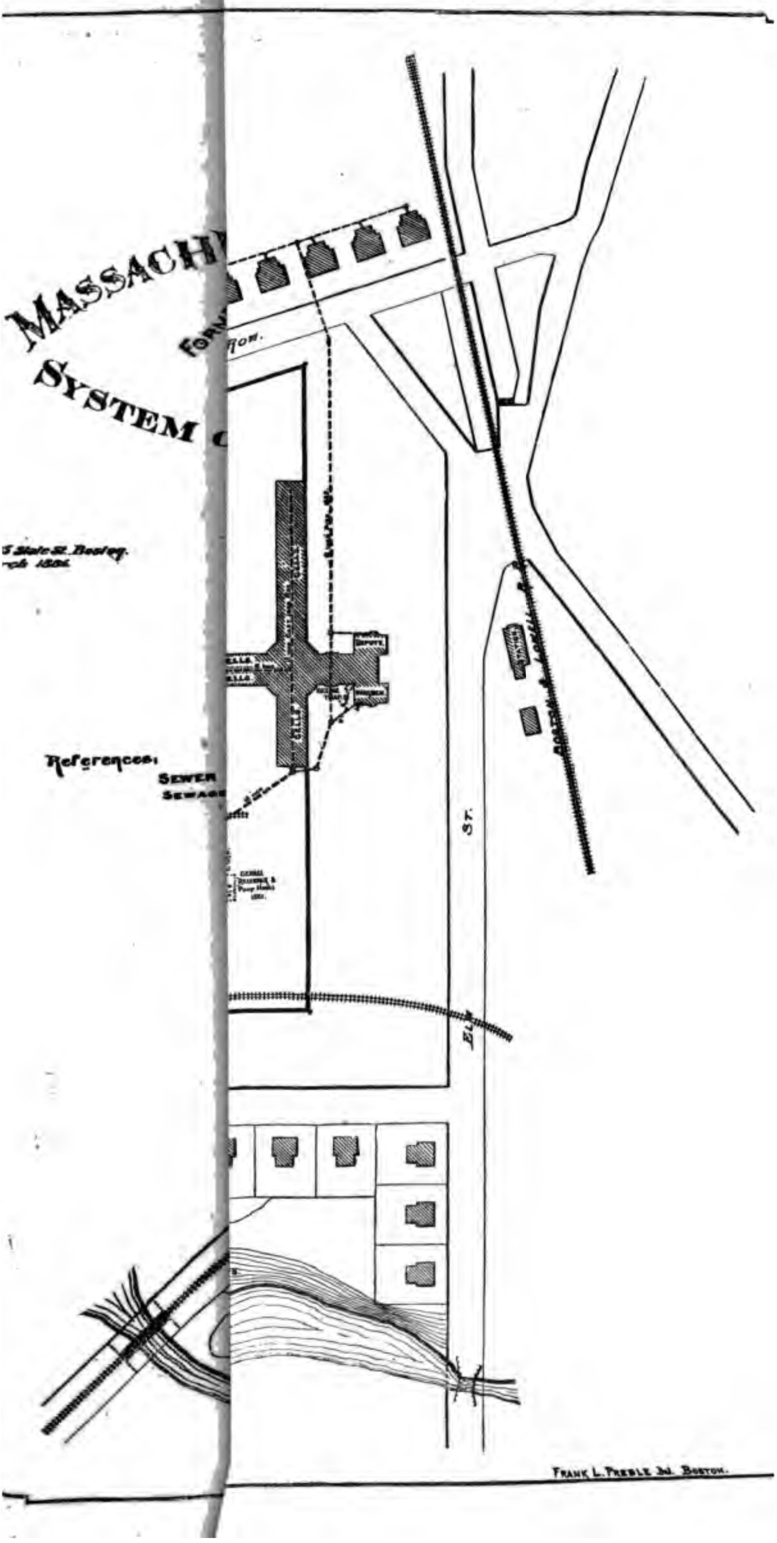
Plate I of the accompanying plans, compassing the entire group of prison buildings and officers' tenements, shows the general arrangement of the new system of drains and the works for receiving and disposal of the sewage.

Plate II represents, upon a somewhat diminutive scale, the principal features of the receiving and separating works, or pumping station.

The plan of the new works, while leaving substantially unchanged the general arrangement of plumbing and interior drains, involved the construction of an entirely new system of pipe sewers outside the prison buildings, from which storm water is excluded except at a few points for flushing purposes, as later described, and whereby all the ordinary sewage is carried to a series of underground receiving and separating tanks or chambers. These chambers are separated by brick partitions sixteen inches thick, laid in hydraulic cement mortar, the outside walls consisting of an eight-inch brick lining or interior facing, with an impervious backing of hydraulic cement concrete or beton, constructed *in situ*, after the brick was laid. Every alternate brick in alternate courses is a header, projecting outward half its length, thus affording a perfect bond between the brick face and concrete backing. The whole is built upon a concrete foundation extending over the entire area of the chambers, affording a tight floor three inches thick for the tanks, and footings six inches thick under all walls and partitions, and is covered by two arches whose adjacent skew backs rest upon a middle partition and piers, thus forming a valley which affords a passage for the main collecting sewer and safety-overflow pipes.

The chambers are provided with sewage inlets, sludge outlets and suction pipes for discharging the liquid portion, all in duplicate, and each one in a separate compartment from, and capable of being used interchangeably with its companion. Access to each compartment is had through man-holes of ample size.

The sewage is commonly first admitted through an inlet



MASSACH
SYSTEM C
5 State St. Boston.
rch 1886.
References:
SEWER
SEWAGE
Row.
ST.
FRANK L. PREBLE 3d. BOSTON.

DISPOSAL OF SEWAGE

AT THE

MASSACHUSETTS REFORMATORY,

FORMERLY THE STATE PRISON AT CONCORD.

By William Wheeler, C. E.

A′, has connection through a valve, *b*, with a storage chamber about twenty-five feet square, *BB*, into which the liquid portion flows in the usual operation of the works, the said liquid portion being pumped out daily through either or both of the suction pipes, *c* and *c′*, as circumstances may require.

The second chamber, *A′*, is practically a duplicate of the first one, *A*, and may be used interchangeably, with either the first one as the primary receiving and separating compartment (in which case the crude sewage is admitted through an alternate inlet valve, *a′*), or with the larger one, *BB*, as a storage chamber and pump well; or, as ordinarily used, in open connection therewith, it affords simply an addition to the storage capacity of the works.

With this interchangeability of uses, effected by simple devices, the function of each compartment may be performed by one of the other two, whereby each may in turn be left in temporary disuse, thus facilitating the work of discharging the sludge, and the examination, repair and general care of the works.

By causing the liquid overflow from the receiving chamber to take place from the middle of its depth, the solid matter, which either floats or sinks, remains in the chamber, where it is allowed to accumulate until it approaches the level of the inlet of the overflow pipe or siphon. The sludge is then discharged by gravity through the valve *e* or *e′*, as the case may be, and an eight-inch akron pipe, *f*, into a composting pit situated about six hundred feet distant, on the low bluff overlooking the river. Here the excess of liquid that flows out with it is allowed to leach away into the dry, porous soil, and the residue is covered (at intervals of about two or three days) with a light layer of dry loam, muck or other absorbent, whereby it is rendered odorless and innocuous, and its fertilizing value developed and preserved. Before the next discharge is to occur, it is in suitable condition to be carried away, and composted with more absorbents, or applied directly to the land, with results which demonstrate its agricultural value. In practice, with the present population served by these works, numbering about 650 convicts, and upwards of twenty officers' families, and disposing of

about 100,000 gallons of sewage daily, the sludge is discharged once in two weeks. The accumulations of that period furnish a deposit of from eighteen to twenty inches deep upon the bottom of the receiving chamber, and floating matter to a thickness of from six to ten inches upon the top of its contents. After a thorough agitation with a pole, through a man-hole, during which about one-half to three-fourths of the floating matter sinks, the discharge valve is opened and the entire contents gravitate into the sludge pit, which has been made ready by cleaning out the preceding charge, and loosening up the bottom to facilitate the leaching away of the excess of liquid as already described.

Two open sludge pits, each about 12 × 40 feet, were originally constructed, to be used alternately, but one has recently been found to serve the purpose, after covering it with a substantial building to exclude rain and snow, and to confine the odor occurring temporarily during the flow of the sludge into it. Although situated within from 150 to 400 feet from six double houses occupied by officers of the prison, the resident engineer states that no complaints have arisen therefrom since it was so housed.

Over one of the small compartments, A', of the receiving chambers, a small pump house is built, the walls of the compartment constituting the foundations of the building. (See "Plan of Pump House," also "Vertical Section on E. F." Plate II.)

The pump room contains a small Knowles tank sewage pump, having its steam cylinder eight inches and plunger ten inches in diameter, with a twelve-inch stroke, and connected with an upright tubular boiler, thirty-six inches in diameter and seven feet high, — both pump and boiler being constructed expressly for these works. The pump has two suction pipes, c and c', whereby the sewage may be pumped directly from either chamber, A' or BB, whence it is delivered through a six-inch iron force-main to the various points at which it is to be disposed of by irrigation. It is discharged through common fire hydrants made with one specially large nozzle, and two hose nozzles of ordinary size. Two sewage hydrants are placed within the prison yard, where large quantities are used for the irrigation of its sandy

soil, and two more outside the enclosure upon the highest points of the arable land of the prison farm and at distances of about 400 and 600 feet from the driven wells. (See Plate I.)

Here the sewage is used in broad irrigation upon such desirable crops as are best fitted for cultivation therewith,— chiefly grasses and grains, as well as general tilled crops to a limited extent. The soil, being light, free and sandy, with the natural water-table at a considerable depth below its surface, is eminently well adapted to receive the sewage, which it does with great benefit to itself, and without complaint of odor or appearance of disagreeable results of any sort; and this notwithstanding the fact that the methods pursued for its distribution are still somewhat crude. The sewage is received at an elevation of several feet above the ground, into a line of wooden troughs supported upon light "horses" or portable trestles, graduated in height so as to secure a suitable fall toward the points of final discharge, and is often allowed to run two weeks, during the hours of pumping, in one place without change.

Undoubtedly a more convenient and economical, and certainly a more sightly management of the sewage would be effected by suitably grading the surface of the utilization grounds, and constructing shallow open conduits and surface channels, provided with suitable contrivances for deflecting the flow toward any desired part of the field, and through which the sewage would be distributed by gravity and regulated at pleasure.

The inconvenience of moving the present arrangement troughs and trestles affords a potent temptation to undu prolong the time of flow in a single place. The duration flow in one place, under the more convenient system of di tribution, could wisely be limited to not more than fo days, on even so free and dry a soil, and while the wor were not originally so constructed by reason of an inad quate appropriation, later recommendations for reformi the methods of distribution in accordance with the foregoi suggestions have been made to the Commissioners, with t offer of gratuitous professional assistance in carrying the into execution. The absence of any particular sanita

motive or necessity, however, for pressing such improvements, may perhaps be held to be a reasonable excuse for neglecting to make them.

The new drains, with a minor exception, are laid in straight lines, with a man-hole at every junction and at every change of direction or grade. The ventilation of the sewers is insured by the admission of air through perforated covers upon certain of the man-holes, whence it circulates to and through the soil pipes which are carried through the roofs of the prison buildings,—the soil pipes of the "strong rooms" also having been so extended in conjunction with the work done under the Act of 1883, with the direct result of entirely obviating the presence of objectionable odors and sewer emanations which had occasionally existed before.

The ventilation of the receiving and separating works is effectually accomplished without objectionable results of any sort, by the constant admission of air through a perforated man-hole cover, *v*, into the primary receiving compartment, *A*, and its positively induced circulation through a series of openings connecting all the compartments above the level of the sewage therein, and leading, by a suitable arrangement of dampers at the base of the furnace, into either the fire-box under the boiler, or the chimney directly over the boiler, where the gases may be burned,—the draught of the chimney in either case effecting the necessary circulation.

The officers' houses upon Commonwealth Row were furnished with water-closets, and together with the Warden's and Deputy-Warden's (now Superintendent's) houses, were connected with this system of works during the months of August and September, 1885, through sewers shown upon Plate I,—the expense for this addition being paid out of the general appropriation for the Reformatory.

Storm water is excluded from the new sewerage works, except in the case of that admitted for flushing purposes by the conductors upon the two houses at the heads of the Commonwealth Row sewers, and also through connecting conductors near the heads of some of the principal drains within the prison yard.

To prevent any back-flow of sewage, in case the contribution of storm water by these connections should be exces-

sively large during the night when the pumps are not ordinarily in operation, a safety over-flow, *d*, is provided, whereby the excess automatically escapes into the sludge pipe, and thence passing by the sludge pits, is discharged into the river. No considerable quantity of objectionable refuse can so reach the stream however, inasmuch as such overflow takes place as already stated at night, when not only is the amount of normal sewage at its minimum, but the overflow itself consists of the secondary contributions of the storm water, after its primary flow has cleansed the sewers and discharged its scourings into the receiving chambers.

With the present consumption of water, amounting as already stated to about 100,000 gallons per day, the night flow of sewage from about 5.30 P.M., when pumping usually ceases, to 7 A.M. when it begins again, fills the sewage reservoirs to within about a foot of the over-flow level, or from 80 to 85 per cent. of their full capacity of about 28,000 gallons. The pumping continues from about 7 A. M. to 10.30 A.M., and again from 3 P.M. to 5.30 P.M. daily, at which time it is left empty, ready for the night flow. The large consumption of water and consequent delivery of sewage during the night, and indeed at all hours of the day, is largely due to the practice by a large number of the convicts, of so placing a small bit of wood or other material under the seats of their water-closet as to cause it to flow with a constant stream, thus maintaining a sense of cleansing and purifying efficacy, which is only imaginary, at the expense of a considerable waste of water, and the disposal of it in the form of sewage.

The winter care and management of the sewage does not differ in any essential degree from that at other seasons of the year, nor does it present any peculiar difficulties or annoyances. The comparative warmth of the sewage enables it to find its way into the ground before freezing to any injurious extent, while the sludge pit, being covered by a close house in which a quantity of dry absorbents is stored, is managed without difficulty.

All labor required in the management and operation of these works is done by convicts. The annual expense of

unning them may be approximately stated as follows, — the ıbor being rated at what would be its fair valuation under ormal conditions of employment: —

55 tons soft coal, at $4 00,	$220 00
Salary of attendant,	600 00
Repairs and sundries,	80 00
	$900 00

The cost of taking care of the sludge pits and utilization rounds would be additional, but it is doubtless more than epaid by the purely agricultural value of the sewage roducts to be cared for and disposed of, under any rational ystem of treatment.

Most of the conductors disconnected from these works ave been re-connected with the old brick sewers, whereby complete double and separate system of sewerage is pro-ded, — the storm water thus finding its way into the river.

The dye refuse and washing water from the hat shops, nounting to about 50,000 gallons daily, was disposed of an independent method, having been collected and carried a six-inch pipe sewer into a pair of open filter beds or ks containing each about 500 square feet, and situated on slope of the bluff east of the prison yard, where it soaked ay without unsightly or unpleasant consequences. These ls or sinks were made in duplicate to enable the bottom l sloping sides of either one to be raked over, and the rly impervious deposit of felting fibre thereon to be noved, while the other was in use. The removal of the industry last year led necessarily to the abandonment of s branch of the works, which is not therefore shown upon accompanying plans.

The water from the purifiers of the gas works, under an angement made by the resident engineer of the Reforma-y, flows into an open rectangular pit behind the gas house. oss one end of the pit is a brick partition having an ning through it below the level of the liquid standing rein. The gas liquor first enters the larger compartment re the oil and light combustible compounds which are ught along with it, gather upon its surface, and remain rein while the water itself flows through the submerged

opening in the brick partition into the smaller compartment. From the latter it flows out through a submerged pipe orifice into a drain leading into one of the old brick sewers, and thence into the river. The combustible supernatant matter remaining in the larger compartment is regularly burned off twice a month.

The removal of the picture moulding shop, which was in contemplation at the time of building the new works, has since been carried into effect, thus taking it out of the drainage problem.

The introduction and operation of the new drainage works has promoted not only the apparent wholesomeness and neatness of the prison and its immediate vicinity, but also the ease and convenience of disposing of all forms of sewage matter. The resident engineer affirms, indeed, that while steam pumping has been substituted for gravitation, for the removal of the sewage proper, the labor involved in the care and operation of the new system is not only less than before, but it is of a far more agreeable nature. These works may serve, furthermore, to demonstrate upon a limited scale, at least, the general merits of the utilization of sewage by broad irrigation,—*first*, in point of cost of works and their operation; *second*, as satisfying the requirements of sanitary principles; *third*, as a source of revenue in the production of farm crops; and finally, as a means for permanently maintaining the fertility of the soil.

CASE OF LEAD-POISONING.

Reported by Frederic W. Jones, M.D.

CASE OF LEAD-POISONING IN ASHBURNHAM,

FROM DRINKING WATER WHERE LEAD PIPE WAS USED.

REPORTED BY FREDERIC W. JONES, M. D.

In the Second Annual Report of the State Board of Health of Massachusetts (1871) the results of an inquiry relative to lead-pipe poisoning are given, in which it is shown that 170 correspondents answered the inquiry as to the prevalence of such poisoning, of which number 41 reported cases of its occurrence in various parts of the State, the number of cases amounting to sixty or more. Since the publication of that report, cases of lead-poisoning have been of more rare occurrence, if we may judge by the reports received by the Board.

There can be but little doubt that the free discussion of the subject at that time has produced a salutary effect. The general introduction of iron pipe for water service is desirable wherever a potable water is used which acts perceptibly upon lead pipe.

The following appears to be unquestionably a case of this nature. The history of the case, the symptoms exhibited, the analysis of the water, seem to confirm the diagnosis beyond question. A qualitative analysis only was made, the sample of water sent being insufficient for a complete quantitative analysis.

To the State Board of Health of Massachusetts:

While visiting a patient in Ashburnham, Mass., in September, my attention was especially called to a sick lady, a sister of my patient, who had been at his house only a few days.

Upon questioning, Miss C. B——, whose face exhibited a marked cachexia, with dulness of the eyes, gave the following symptoms: General weakness, loss of flesh, poor appetite:

extremely nervous, with hysterical paroxysms; bowels constipated, with great abdominal pain at times; impaired motion of hands and right arm, with partial loss of motion of extensor muscles; legs somewhat affected, fetid breath and peculiar sweetish metallic taste in mouth.

An examination of her mouth and teeth showed the characteristic lead line upon the gums of both the lower and upper teeth, from incisors to extreme molars; also, a lead coloring, covering the central part of the lower lip. The case was immediately pronounced by me, — lead poisoning, from drinking water coming through a lead pipe.

Patient able to sit up; temperature normal; pulse accelerated to 120; respirations slightly increased; usual weight 120 lbs., then weighing 92 lbs. A messenger was dispatched to procure water from the pump in the house situated near the cotton mill at Ashburnham Centre. The water was subjected to a qualitative analysis by me, which immediately revealed the presence of lead as soon as tested, and my diagnosis was conclusively confirmed. In order to have a full analysis I have sent a sample of the water to the State Board of Health of Massachusetts.*

The water was conveyed about 5 rods, from a well to the house, through a two-inch lead pipe by a common copper pump. The pipe and pump were first used in June, 1882, since which time more or less sickness has occurred in the family, which then consisted of the mother, two daughters and a grandson. The mother began to be ill shortly after the pipe was used, and died in the early part of 1884, aged 78, with an alleged tumor of the stomach. The youngest daughter has been ill since October, 1882, and is under medical treatment. The oldest daughter, whose case I report,

* The analysis made confirms the statement of Dr. Jones as to the presence of lead in the water.

ANALYSIS.

Water received October, 1885.

Ammonia,	.0010 parts per 100.000.
Alb. Ammonia,	.0264 " " "
Chlorine,	0.5
Fixed residue,	5.2
Volatile residue,	3.6
Total residue,	8.8
Hardness,	3°

Slightly turbid; no color; no odor; much charring on ignition.
Lead present.

was taken sick in October, 1884. She was in Fitchburg, Mass., four months last winter, and was employed in housework with a marked improvement of general health. Upon her return home sickness again manifested itself, preventing her from working only about one week in the cotton mill where she engaged employment. Since which time she has done but little work. She is now under special treatment for lead poisoning. Her urine has been examined and shows the presence of lead. Another sister has visited the family several times and passed her vacation with them, but always complained of feeling ill whenever she was at the house.

FREDERIC W. JONES, M. D.

REPORTS

OF THE

WATER BOARDS, COMMISSIONERS AND COMPANIES OF MASSACHUSETTS.

REPORTS OF THE WATER BOARDS, ETC.

By the provisions of chapter 80, sections 103, 104 and 105 of the Public Statutes, triennial returns of the water boards and companies located in the Commonwealth are required.

A brief report was made in compliance with this act of 1879, and published in the general report of the Board for that year. A more complete and extended report was published in the supplement to the fourth annual report (1882), giving the returns made by seventy-one water boards and companies which were in existence at that time.

The present, or third triennial, report, required by the act of 1879, comprises the returns of eighty-eight boards and companies, which have been returned to the office of the Health Department.

The whole number of companies and boards having water works in operation at the beginning of this year (1886) was ninety. Their names and locations are as follows: —

In Barnstable County: None.

In Berkshire County: Adams Water Company, Great Barrington Water Company, Cheshire Water Company, Berkshire Water Company (in Lee), Lenox Water Company, North Adams Fire District, Ashley Water Works (Pittsfield), Richmond Water Company, Stockbridge Water Company, Williamstown Aqueduct Company.

In Bristol County: Attleborough Water Supply District, North Attleborough Fire District, Fall River Water Works, New Bedford Water Works, Taunton Water Works.

In Dukes County: None. Cottage City has a water supply for fire purposes only.

In Essex County: Powow Hill Water Company (Amesbury and Salisbury), Beverly Water Works, Danvers Water Works, Haverhill Aqueduct Company, Lawrence Water Works, Lynn Water Works, Marblehead Water Company, Newburyport Water Company, Peabody Water Works, Salem Water Works.

In Franklin County: Glen Water Company (in Greenfield), Sunderland Water Company, Turner's Falls Company.

In HAMPDEN COUNTY: Agawam Water Company, Chicopee Water Company, Holyoke Water Works, Crystal Spring Aqueduct Company (Holyoke), Springfield Water Works, Westfield Water Works, West Springfield Aqueduct Water Company.

In HAMPSHIRE COUNTY: Amherst Water Company, Spring Water Company (Amherst), Northampton Water Works, South Hadley Falls Water Works.

In MIDDLESEX COUNTY: Arlington Water Works, Cambridge Water Works, Concord Water Works, Everett Water Works, Framingham Water Company, Hudson Water Works, Lincoln Water Works, Lexington Water Company, Lowell Water Works, Malden Water Works, Marlborough Water Works, Medford Water Works, Melrose Water Works, Natick Water Works, Newton Water Works, Somerville Water Works, Wakefield Water Company, Waltham Water Works, Watertown Water Supply Company, Wayland Water Works, Highland Water Works (Winchester), Woburn Water Works.

In NANTUCKET COUNTY: One — Wannacomet Water Company.

In NORFOLK COUNTY: Brookline Water Works, Dedham Water Company, Franklin Water Company, Norwood Water Works, Quincy Water Company, Sharon Water Company, Wellesley Water Works.

In PLYMOUTH COUNTY: Brockton Water Works, Hingham Water Company, Kingston Aqueduct Association, Middleborough Water Works, Plymouth Water Works, South Abington Water Works.

In SUFFOLK COUNTY: Boston Water Board, Chelsea Water Works, Revere Water Company, Winthrop Water Company.

In WORCESTER COUNTY: Athol Water Company, Clinton Water Works, Fitchburg Water Works, Gardner Water Company, Leominster Water Board, Milford Water Company, Northborough Water Works, Southbridge Water Supply Company, Spencer Water Company, Webster Water Works, Westborough Water Works, Worcester Water Works, Uxbridge Water Company.

In addition to the companies named in the foregoing list, there are also thirteen other companies or towns intending to introduce public water supplies, to whom the Legislature has given the necessary power and authority to construct works and introduce such supplies. Some of these have been organized for several years. The list is as follows:

In BERKSHIRE COUNTY: Hill Water Company (Stockbridge).
In DUKES COUNTY: Cottage City.
In ESSEX COUNTY: Bradford, Swampscott, Nahant.
In FRANKLIN COUNTY: Deerfield, Erving, Orange.
In MIDDLESEX COUNTY: Maynard.
In NORFOLK COUNTY: Milton.
In PLYMOUTH COUNTY: Hanson, Rockland.
In WORCESTER COUNTY: Lancaster.

For convenient reference the Act of 1879 is herewith given in full. The numbers prefixed to the replies of the several water boards and companies correspond to those in the second section of the following act: —

PUBLIC STATUTES, CHAPTER 80, SECTIONS 103, 104, 105.

[Acts of 1879, chapter 270, sections 1, 2, 3.]

1. Water boards, water commissioners, and water companies making use, as a source of water-supply, of any pond, stream, reservoir, or well, within the commonwealth, and distributing the waters thereof for public, domestic, and general uses, shall make returns to the state board on or before the first day of November in every third year, beginning with the year eighteen hundred and eighty-two, of the facts hereinafter enumerated: *provided*, that the expense incurred by any such board, commissioners, or company, shall not exceed fifty dollars. And the state board shall publish triennially, in its report to the legislature, the returns received, arranged by counties separately, and those from each county alphabetically.

2. Each of such water boards, commissioners, and companies shall state in the proper places on the blanks which the state board shall, on application, furnish for the purpose, —

1. Its name, charter, or other legal basis, and place of business.

2. The source or sources of its water-supply, and the name, if any, and location of each.

3. The superficial area of its water-surface, if pond, reservoir, or large well.

4. The area of water-shed supplying such source or sources.

5. The general geological and topographical character of the water-shed.

6. The estimated capacity of each such source by average daily flow.

7. The estimated capacity of each such source by minimum daily flow.

8. Whether the water-shed is also wholly or in part that of other ponds, streams, or reservoirs, besides that used by the party making return; and if so, to what extent.

9. Whether or not the source employed by the party making return is used jointly by some other party for a water-source; and if so, by whom.

10. Whether there are other sources within ten miles, not already appropriated by law, that could be availed of in connection with the source or sources now enjoyed by the party making return; and if so, what, and their location, area, water-shed, and the means necessary to connect, with the distance from present source, and from territory to be supplied.

11. What danger of contamination the waters at present held are liable to.
12. Whether or not an analysis has been made of the water at present used, and the results of any such; by whom, and where.
13. Whether the waters at present used have been stocked with fish; if so, to what extent, by whom, and where.
14. What up to date has been the cost of the water-works in use, including rights and lands taken, and all damages paid; stating cost of water-rights separately, and to whom paid.
15. Whether the storage capacity of the present source can be increased, and at what probable cost, exclusive of damage by flowing, and at what damage to private parties or corporations.
16. Whether any town, village, or city discharges its sewers or drains into the source used by the returning party, or their tributaries.
17. The population of the town, city, or village so discharging its sewers or drains into said source, and the character of its manufactures.
18. The apparent results of such sewage.
19. The average daily consumption for the year of the population supplied by the party making return.
20. The per centum used by families.
21. The average consumption per family, per day.
22. The probable increase of demand, as near as can be estimated for the next year.
23. The water-rates established.
24. The system of distribution, whether by gravity, stand-pipe, direct pumping, reservoir, or otherwise
25. The condition of water debt and sinking-fund.
26. How the effluent water is now got rid of.
27. Into what stream or body of water it finally flows.
28. What protection against impurity of present source not now provided is desired.
29. What additional expense such protection would involve, and to whom.

3. The state board shall, on application from the parties who are required to make said returns, furnish the requisite blanks therefor; and any water board, commissioners, or company required to make said returns shall for every neglect or failure so to do forfeit fifty dollars to the use of the local board of health, or the proper officers acting as such, of the city or town in which such delinquent has its principal office. And the state board shall prosecute, by an action of tort in the name of the commonwealth, for the recovery of the penalty or forfeit herein imposed.

BERKSHIRE COUNTY.

Great Barrington.

1. Great Barrington Water Company.
2. A mountain brook and springs.
3. Three-quarters of an acre.
4. Perhaps 1,000 acres of the side of the mountain.
5. Earth and blue rock.
6. No data.
7. No data.
8. No.
9. None.
10. Yes.
11. None.
12. Yes. No figures given.
13. Yes.
14. About $25,000.
15. Storage capacity cannot be much increased.
16. No.
17. None.
18. None.
19. Some 350 families.
20. One-half.
21. No data.
22. Not large.
23. Family of 2 persons, $6; 8 persons, $8; boarding-houses, $12; stores and shops, $4 per year; bath-tub and water-closet, $3 each.
24. Gravity.
25. No debt.
26. Sewers.
27. Housatonic River.
28. None.
29. None.

1. Mansfield Lake Aqueduct Company, Great Barrington, Mass., whose water is only used in case of fire. Established by Acts of 1884.

Cheshire.

1. Cheshire Water Company, Cheshire.
2. Springs feeding Thunder Brook.
3. About three-quarters of an acre.
4. From 600 to 1,000 acres.
5. Limestone. Rolling ground.
6. Enough for present needs.
7. Unknown.
8. No.
9. No.
10. One other; Kitchen Brook. About same area and watershed; one-half mile of pipe and dam.

11. None but vegetable decomposition.
12. One. State chemist. Very pure.
13. No.
14. $17,051.12.
15. Yes; by another dam. Cost $1,000. None to private parties.
16. None.
19. No meter.
22. Increase, five per cent.
23. Per family, $7 — $12.
24. Gravity, 265 feet head.
25. No debt; no fund.
27. Hoosac River.
28. None.
29. None.

Dalton.

1. Dalton Fire District.
2. Egypt Brook.
3. One-half acre.
4. Supplied from springs.
6. 400,000 gallons daily.
10. Two (2) brooks could be connected by laying one mile of pipe.
11. None.
12. *(See page 280.)*
13. Trout.
14. $48,011.79.
15. Can be increased at a trifling cost.
16. None.
19. 90,000 gallons.
22. 10,000 gallons.
23. One family, $6 to $8; bath-tubs, $2; water-closets, $3.
24. Gravity.
25. $50,000 debt; no sinking-fund as yet.
26. Follows natural bed.
27. Housatonic branch, east.
28. None.

Lee.

1. Berkshire Water Company, Lee.
2. Mountain streams.
3. Thirty acres.
4. Three square miles.
8. No.
9. No.
10. Present sources are ample.
11. None except forest drainage.
12. No.
13. Brook trout only.
14. Approximately, 30,000.
15. Yes, at nominal cost; no damage.
16. No.
19. No calculation.

23. Single family, $8; tenement-houses, each family, $6; water-closet, $4; bath-tub, $4.
24. Gravity.
25. Private company.
27. Housatonic River.
28. None.

Lenox.

1. Lenox Water Company.
2. Mountain springs and mountain brook.
3. Small reservoir, possibly one-quarter of an acre.
4. About 500 acres.
5. Trap rock mountains.
6. 35,000, 150,000 = 185,000 gallons.
7. 25,000, 100,000 = 125,000 gallons.
8. Used exclusively by company.
9. No.
10. There are other streams that could be used by forcing the water, possibly increasing present supply fifty per cent.
11. None.
12. By Prof. James Crafts of Boston; water very pure, with small trace of lime.
13. Small reservoir is stocked with trout.
14. $25,797.30; damages and rights, $2,409 95.
15. Storage capacity can be increased without damage by flowage; cost would depend on size of dam and amount of excavation.
16. No.
17. None.
18. None.
19. 40,000 gallons.
20. Ninety per cent.
21. Estimated 250 gallons.
22. Slight.
23. $10 per family; bath-tubs, $5; water-closet, $5; horse, $2; cow, ; hydrants, $5 and upwards.
24. Gravity and pumping.
25. None; we have $22,000 in stock issued.
26. By sewers by Col. Geo. E. Waring's system of absorption.
27. What little escapes from absorption lot finally flows into the Housatonic River.
28. None.
29. None.

North Adams.

1. North Adams Fire District.
2. Notch Brook, 500 feet above village; artesian well in village.
3. Two and one-half acres.
7. 400 gallons a minute.
8. No.
9. No.
10. Yes.

11. None.
12. Yes. No figures given.
13. No.
14. $215,000.
15. Yes.
16. No.
17. No.
18. No.
19. 1,000,000 gallons.
20. No estimate.
21. No estimate.
22. No estimate.
23. Dwelling-house, $8 per year; tenement, $6 per year; bath, $3 per year; water-closet, $3 per year; urinal, $1.50 per year; store or saloon, $6 per year; meat market, $10 per year; horse, $2 per year; hands, labor, 40 cents per year.
24. Gravity and direct pumping.
25. $170,000.

Pittsfield.

1. Ashley Water Works, Pittsfield, owned by the Fire District of Pittsfield.
2. Ashley Lake is in the town of Washington. Ashley Brook is partly in Washington and partly in Dalton. The Sackett Brook is partly in Hinsdale and partly in Dalton.
3. About 80 acres.
4. The watershed of Ashley Lake is small, probably not over 300 acres. It is supplied largely by springs. The watershed of the two brooks it is impossible to estimate, except in the most general way.
5. Mountain lake and brook.
6. The average daily flow cannot be even roughly estimated. At certain times in the year the brooks have very large quantities of water, coming from heavy rains and melting snows, which run to waste.
7. The minimum daily flow cannot well be estimated, for when the brooks fail to supply sufficient water for use in the district the lake is drawn upon by opening the gate at the outlet, letting the water flow into the Ashley Brook, about two and one-half miles above the reservoir, where it is taken into the main pipes. In the extreme cold weather of winter, on account of the waste, to prevent the water from freezing in service-pipes and in houses, and in the warm dry weather of summer, four or five million gallons of water are supplied daily.
8. No other use made, or other ponds or reservoirs supplied.
9. None.
10. There are other sources of supply of indefinite extent.
11. None, except from farm-houses.
12. By Dr. Chas. T. Jackson in 1851.
13. No.
14. $227,000.
15. It can; at a nominal expense.
16. No.

19. We have no means of estimating this except in the most general way. It is safe to say 3,500,000 gallons.

20. Only the roughest estimate can be made. The waste of water here is very large for various reasons. It is safe to say that two-thirds of the water supplied is absolutely wasted. Perhaps one-third is used or wasted in families.

21. At a rough estimate, again, perhaps 500 or 600 gallons per day.

22. On account of the Boston & Albany R. R. Co. having taken another source of supply, for their engines, there will be a falling off rather than an increased demand during the present year.

23. $5 to $7.50 per family; bath-tubs, $2.50; public tubs, $5; water-closets, $3 75; each additional, $1.88; water-closets not approved by commissioners, $12.50; stables, each horse, $1.25; measured water, 6¼ to 12½ cents per 1,000 gallons.

24. Gravity.

25. $202,904.04.

26. By sewers, cesspools, etc.

27. Housatonic.

28. None.

29. None. The water supply being obtained from a mountain lake, with no houses on its shore, and from brooks running down mountain ravines, the water furnished is uncontaminated and very pure. Even when the water from the lake has a swampy taste, it becomes pure and fresh in tumbling down the mountain over the rocky bed of the brook before it reaches the distributing reservoir. The water is also very soft. The waters of the lakes and streams westerly of the village are hard, and unfit for domestic and other purposes on that account. The supply can be indefinitely increased by raising the dam at the lake (we now draw eight feet from it) and by constructing a pumping station, to supplement the supply in dry times, on quite a large brook on the line of main pipes about a mile from our present reservoir, and about one hundred below it in height.

Richmond.

1. Richmond Water Company. (Richmond Furnace.)
2. Small brook.
3. Reservoir; one-third of an acre.
11. Sewage and cattle.
12. None.
13. No.
14. About $5,000; damages, $300.
15. Can be increased for $5,000.
16. Not directly.
22. About twenty families.
23. None.
24. Gravity.
25. None.
27. Williams River.
28. Stop sewage from outhouses and barns.
29. Richmond Iron Works, to whom water works belong.

Stockbridge.

1. Stockbridge Water Company.
2. Spring and artesian well.
3. Reservoir about two rods square.
4. Several thousand acres.
5. Mica, slate and limestone on high, rugged mountain.
6. About 1,440,000 gallons.
7. About 288,000 gallons.
8. No.
9. No.
10. No.
11. None.
12. Yes, very pure; H. L. Bowker.
13. No.
14. About $30,000.
15. Yes.
16. No; the spring and well are above any habitations.
19. No estimate.
20. Seventy-five per cent.
21. No estimate.
22. None.
23. $8 per family; $2 each per bath-tub and water-closet.
24. Gravity.
25. $10,000 in bonds.
28. None.

South Adams.

1. South Adams Fire District.
2. Reservoir, No. 1; springs at base of mountain. Reservoir, No. 2; highlands in east part of Cheshire.
3. Three acres.
8. No.
9. No.
10. Other mountain springs.
11. None.
13. No.
14. $175,000.
15. Yes.
16. No.
22. Fifty families.
23. $5, $6.66, $7.50 per family.
24. Gravity.
25. Notes and bonds.
26. Passes over the dams.
27. Hoosac River.
28. None but what our charter gives us.

Williamstown.

1. Williamstown Aqueduct Company, Williamstown, Mass.
2. Spring.
3. No area.
6. No estimate.
7. No estimate.
8. No.
9. No.
10. Other springs can be had.
11. None.
12. Not recently.
13. No.
14. $12,000.
15. No estimate.
16. None.
20. No estimate.
21. No estimate.
22. Fifteen to twenty families.
23. $8 per family.
24. Gravity.
25. None.
27. "Doctor Brook."
28. None.

BRISTOL COUNTY.

Attleborough.

1. Attleborough Water Supply District.
2. Artesian well; on west bank of Ten Mile River.
3. No estimate.
6. 200,000 gallons per day by estimation.
9. No.
11. Sewerage from river.
13. No.
19. Estimated 80,000 to 100,000 gallons.
20. Eighty-five per cent.
21. 113 gallons.
22. Five per cent.
23. Family use, 40 cents per 1,000 gallons.
24. Stand pipe.
25. Debt, $72,000; sinking fund, $13,000.
26. Sewers and cesspools.
27. Ten Mile River.

North Attleborough.

1. Fire District Number One, North Attleborough, Mass.
2. Large well in meadow.
3. 530 square feet.
4. About three square miles.

5. Gravelly soil.
6. 5,000,000 gallons.
8. No.
9. No.
10. Yes; large lake in Wrentham, by laying pipe three miles from present supply.
11. None.
12. HARVARD MEDICAL COLLEGE, CHEMICAL LABORATORY, BOSTON, November 10, 1884.

WATER ANALYSIS.

[Figures express parts per 100,000 of water.]

Free ammonia, 0.0010; "albuminoid" ammonia, 0.0148; chlorine, 0.5600; residue, fixed, 5,000; residue, volatile, 2,700; total residue, 7,700. Hardness, English degree, 1. Date of reception, November 7, 1884. Transparency, slightly turbid, considerable brownish sediment. Color, none. Odor, none. Characteristics on ignition, slightly blackening. Nitrates, absent by ferrous sulphate test. Remarks, a good surface water. It contains no excess of organic matter.

EDWARD S. WOOD.

13. No.
14. $120,852.50.
15. Storage can be increased, but not at source.
16. No.
18. None.
23. Dwelling-houses, occupied by one family, for the first faucet, $6; each additional faucet to be used by the same family, $2; bath-tub $5; water-closet, $5. Boarding-houses, first faucet, $10; each additional faucet, $3; bath-tub, $10; water-closet, $10. Stables: first horse, $5; each addditional horse, $2; first cow or ox, $2; each additional cow, $1. Hose, from April 1st to October 1st, $5.
24. Stand pipe, reservoir, and direct pumping
27. Ten Mile River.
29. None.

Fall River.

1. Fall River Water Works.
2. Watuppa Lake.
3. 5.43 square miles.
4. 25.82 square miles.
5. Stony; gradual slope.
9. The Watuppa Reservoir Company depends somewhat upon the flow of Quequechan River, the natural outlet of Watuppa Lake, for water power.
10. No.
11. Practically none.
12. Prof. John H Appleton of Brown University; 18.70 to an American gallon; organic and volatile matter, $\frac{84}{100}$ grains; mineral matter $\frac{96}{100}$ grains; hardness, 20.
13. Somewhat.
14. Trial balance of Water Works: ledger, Jan. 1, 1886, $1,585,640.47; damages awarded, $62,000; half has been paid.

16. No.
19. 26.17 gallons average for each inhabitant.
21. 26.17 gallons per inhabitant.
22. No estimate.
23. Dwelling-houses, first faucet, $5; first bath-tub, $5; each additional bath-tub, $4; first water-closet, $5; each additional water-closet, $3. Boarding-houses, first faucet, $10; each additional faucet, $2. Hotels, for each bed for boarders, $2; stores and offices, $5. Hose, $6 to $10.
24. Stand pipe.
25. Net debt, $1,576,123.48.
27. Mount Hope Bay.
28. Land bordering on lake should be owned or controlled by city.

New Bedford.

1. New Bedford Water Works.
2. Artificial reservoir by dam at head of Acushnet River.
3. 300 acres.
4. 3,300 acres.
5. Porous sand and gravel, formed of and underlaid by primitive rocks, covered with pine woods.
6. Capacity of storage reservoir, 313,000,000 gallons; maximum flow in 1861, 42,163,668 gallons.
7. Minimum flow, 2,999,808 gallons.
8. No.
9. No.
10. Two ponds, Long Pond and Little Quittacus, two and one half miles from present supply, and twelve miles from New Bedford. These ponds are located in Lakeville. Area, Long Pond, 1,800 acres; Little Quittacus, 320 acres; watershed, 35,000 acres. Could be connected by a canal or conduit.
11. None.
12. OCTOBER 15, 1885.

	Ammonia.	Albuminoid Ammonia.	Oxygen required. Kubel's Method.	Solid Residue. Inorganic.	Solid Residue. Organic and Volatile.	Solid Residue. Total at 212 deg. F.	Chlorine.
Little Quittacus,	0.004	0.019	0.435	1.78	1.40	3.18	0.49
Storage Reservoir,	0.006	0.023	0.785	3.68	2.08	5.76	0.52
" "	0 003	0.033	0.927	2.92	1 52	4.42	0.53
Receiving Reservoir,	0.002	0.039	1 067	2.72	1.64	4.36	0.53
Distributing Reservoir,	0.011	0.037	1.048	2.52	1.90	4.42	0.57
City Hall,	0.002	0.031	0.928	2 68	1 88	4.56	0.55

13. No.
14. $1,217,592.13; water rights, $23,739.56.
15. No estimate.
16. No.

17. No.
18. No.
19. 2,876,167 gallons.
20. No estimate.
21. Gallons per day to each inhabitant, 85; gallons per day to each consumer, 113; gallons per day to each tap, 579.
22. Ten per cent.
23. One faucet, $2.50; each additional, $1.25; bath-tub, $2.50; each additional, $2; pan water-closet, $2.50; each additional, $1; hopper-closet, $10; each additional, $5. Stables, one horse, $2; two horses, $3; one cow, 50 cents. Hose, for gardens, windows, etc., $2 50. Hotels, each bed, $1; hopper-closet, $15. Metered water, 1,000 gallons, 15 cents; 1,000 gallons for manufacturing purposes, 2¼ cents.
24. Reservoir.
25. Debt, $850,000; no sinking fund.
26. Sewers and cesspools.
27. Acushnet River and Buzzard's Bay.

Taunton.

1. Taunton Water Works.
2. Ground water and Taunton River.
4. The Taunton River drains 450 square miles.
6. 1,500,000 gallons per day from the ground water. River supply is 40,000,000 gallons per diem.
9. No.
10. Assowompsett Pond, in Middleborough, by aqueduct; cost, perhaps, $500,000.
11. Sewage of East Taunton, Middleborough and, perhaps, Brockton.
12. Prof. W. R. Nichols in 1877, and in 1885 by Prof. E. S. Wood.
13. No.
14. Cost of works, Nov. 30, 1885, $479,023.86; land damages, about $10,000.
15. Conduit or under ground gallery can be extended by taking more land.
16. Yes; Middleborough.
18. No result apparent.
19. 675,870.
20. Seventy-five per cent.
22. Ten per cent.
23. One faucet, $5; each additional, $2; bath-tub, $3; each additional, 2; pan water-closet, $5; each additional, $2.50; hopper-closet, $10. Boarding-houses, one faucet, $10; each additional, $3; pan-closet, $10; hopper-closet, $20. Hotels, each bed, $3. Stables, one horse, $4; each additional, $1.50; each cow, 1.50. Fire hydrants, $30. Measured water, 1,000 gallons, 12½ to 25 cents, according to quantity used.
24. Direct pumping.
25. Debt, Nov. 30, 1885, $451,700; sinking fund, $127,654.
26. Mill River, Taunton River, and Cobb's Brook.
27. Taunton River.

DUKES COUNTY.

Cottage City.

ottage City Water Company. Established by Acts of 1883. A
; station for fire purposes only. (A supply for domestic use, in
lation.)

ESSEX COUNTY.

Amesbury.

owow Hill Water Company, Amesbury and Salisbury, Mass.
'ells in Salisbury.
wenty feet in diameter.
lay, sand and rock. Hilly.
i0,000 gallons.
,000 gallons.
o.
o.
'ithin 7,500 feet of present supply and 200 feet from main line,
mile from the centre of territory now supplied. Capacity not
' known, but probably 500,000 gallons daily; located in Ames-

o.
o.
30,000, total cost of works to date.
o need of increase. Capacity, 2,000,000 gallons.
o.
o.
one.
),000 gallons.
welling-houses occupied by one family, for first faucet, $7;
litional faucet, $2.50; for the first bath-tub, $5; for each ad-
bath-tub, $2; water closet, $5. Boarding-houses, for first
10; each additional faucet, $3; water-closet or bath-tub, $10.
saloons, workshops and restaurants, $6 to $25. Private sta-
horse, $5; each additional horse, $2. Livery, club and board-
, not exceeding five horses, $15; for each additional horse, $2.
id cart stable, each horse, $3. Hose, not over one-eighth inch
mited to one hour a day, $6. Steam engines, $7 to $10. For
purposes, 7 cents for each cask of lime or cement used.
igh and low pressure reservoirs.
10,000 debt.
owow River.
one.

Beverly.

everly. Refers to report of Salem Water Works.

Danvers.

anvers Water Works.
liddleton Pond, in Middleton.

3. 90 acres.
4. 2,200 acres.
8. No.
9. No.
10. Swan Pond — a mile or more from Middleton Pond — 68 acres. Watershed, 222 acres, can be connected by a trench 2,000 feet long.
11. None.
12. Have no record; said to be equal to Wenham Lake.
13 Yes; by town of Middleton.
14. $240,130.30, entire cost of works; $6,563.02, damages.
15. Our dam will increase capacity for storage. Damage by flowage, cannot estimate.
16. No.
17. No.
18. No.
19. 430,930 gallons.
20. Not estimated.
21. No data.
22. Very little, if any.
23. $6 for first faucet; $1 for second.
24. Reservoir.
25. Water debt, $225,465.05; sinking fund, $17,720.61.
26. Sewers and drains.
27. Tide-water, Atlantic Ocean.
28. None.
29. None.

Haverhill.

1. Haverhill Aqueduct Company.
2. Crystal Lake, Kenoza Lake, Lake Salstontall and Pentucket.
3. 500 acres.
4. No estimate.
5. Gravelly hills used for pasturage; a little woodland.
6. No estimate.
7. No estimate.
8. No.
9. No.
10. Merrimac River.
11. None.
12. Drs. J. R. Nichols and S. D. Hayes. No figures given.
16. No.
23. Each family not more than three, $5; each additional person, [illegible] water-closet, $5. Private stables, each horse and carriage, $3. Boarding-houses, $10 to $20; bath-tub, $3. Bar-rooms, $10 to $30.
24. Gravity for low service. Pump and tank for high service.
27. Merrimac River and Atlantic Ocean.

Lawrence.

1. Lawrence Water Works.
2. Merrimac River, above the dam of the Essex Company.

4. 4,136 square miles.
5. Granite hills of New Hampshire and northern Massachusetts.
9 City of Lowell.
10. Small ponds in Andover, Mass, and Salem, N. H., neither of which were considered sufficient at time of construction.
11. Sewage from all cities and towns situated on the line of the river and its tributaries above us.
12. Prof. E. S. Wood. *(See page 280.)*
13. By fish commissioners of New Hampshire.
14. $1,894,653.94, total cost to Jan. 1, 1886; $15,000 paid Essex Company for water rights.
16. Yes.
17. Lowell, 60,500; Nashua, 13,000; Manchester, 33,000; Concord, [illegible],000; Fitchburg, 12,000, and many smaller towns.
19. 2,300,000 gallons.
20. Fifty per cent.
21. 151 gallons to each of 7,619 families supplied.
22. Six per cent.
23. Apothecaries, $6; bar-rooms, $5 to $15; barbers, $3; club or lodge room, each faucet, $3; dining-room or oyster saloon, $10 to $20; dwellings, $5; boarding-houses of 12 persons, $8.50; for every additional person above 12 in number, 35 cents; fish market, $10 to $20; [illegible] three-eighths of an inch orifice, $2.50; meat and provision market, [illegible] to $12; stables, first horse, $3; for each additional horse, $2; for [illegible], club, livery or boarding stables, not less than $24; for each cow, [illegible]50.
24. Reservoir.
25. $1,300,000, bonded debt; $318,572.64, sinking fund.
26. Sewers.
27. Merrimac River, below the dam.
28. A similar system of drainage for the valley of the Merrimac to that proposed by the State Commission for the valleys of the Mystic, Blackstone and Charles rivers.

Lynn.

1. Lynn Water Works.
2. Breed's and Birch ponds in Lynn and Saugus, Hawkes Brook and Penny Brook in Saugus; water by canal and pipe, direct to pumping station.
3. Breed's Pond, 63 acres; Birch Pond, 84 acres.
4. Breed's Pond, 590 acres; Birch Pond, 490 acres.
5. Wooded country underlaid with ledge; not inhabited or cultivated.
6. Both ponds, 1,400,000; brooks, estimated, 3,000,000.
7. Both ponds, 1,000,000; brooks, estimated, 3,000,000. The estimated flow for both the average and the minimum is the estimated yearly flow, if sufficient storage is provided.
8. Ponds, no. The brooks are a part of Saugus River.
9. No.

10. Saugus River, Ipswich River, Humphrey's Pond in Lynnfield. Saugus River watershed, 20 square miles, can be connected by canal or conduit; distance from pumping station to Howlett's Dam, 4 miles.
11. None.
12. Prof. C. Palmer, Salem Normal School.

PARTS PER 100,000.

Date. 1885.	SOURCE.	Total Solids.	Free Ammonia.	Albuminoid Ammonia.	Hardness.
April 9.	Breed's Pond, ...	5.9	0.0052	0.024	Not taken.
"	Birch Pond, ...	5.2	0.0140	0.026	"
"	Canal (Hawkes Brook), .	5.0	0.0050	0.020	"
May 30.	Breed's Pond, ...	5.0	0.0052	0.021	0.25
"	Birch Pond, ...	5.2	0.0080	0.023	0.28
"	Canal, ...	5.7	0.0080	0.026	0.56
Sept. 17.	Breed's Pond, ...	4.3	Trace.	0.0185	0.6

For the analysis made May 30, Mr. Palmer says: "Some improvement has occurred in the pond waters since my last examination. This is due to their long storage during the spring.

Lynn is very fortunate in having a service water of excellent quality. It is commendable not only as a pure drinking water, but its softness also renders it desirable for general domestic use. Respectfully,

CHASE PALMER."

13. Stocked with black bass by water board. It is feared that they are extinct in Birch Pond, the water having been drawn off.
14. $1,292,509.83, water rights for new supply not settled.
15. New supply can be increased largely; no estimate has been made of the cost.
16. No.
17. No discharge.
18. None.
19. 1,920,519 gallons.
20. Seventy per cent.
21. No data.
22. No data.
24. Pumping and reservoir.
25. $1,264,000, debt; $174,000, sinking fund.
26. Cesspools and sewers emptying into the harbor.
27. Lynn Harbor.

Marblehead.

1. Marblehead Water Company.
2. Tubular wells.
3. Twenty-five feet in diameter.
9. Supplies a part of Lynn and a part of Swampscott.
11. None.
12. Prof. E. S. Wood, Aug. 27, 1885.
14. The town laid its own pipes at an expense of $52,425.33. Mar-

blehead Water Company supplies water at a charge of $175 per million gallons.

24. Stand pipe.
26. Sewers.
27. Atlantic Ocean.
29. Marblehead Water Company.

Nahant.

1. Nahant. Nahant is supplied with water by the Marblehead Water Company.

Newburyport.

1. Newburyport Water Company.
2. Bartlett Springs.
3. Pumping basin, one and three-quarters acres.
4. No estimate.
5. Gravelly and sandy hills.
6. 500,000 gallons.
7. 340,000 gallons.
8. No.
9. No.
10. Distance, three miles from Kimball's Pond, watershed six miles; two and one-half miles from Powow River, watershed twenty-five miles; one-eighth mile from Jackman's Springs, Newburyport; two and one-half miles from Artichoke River, watershed two and one-half miles.
11. None.
12. Karl Castlehun.
13. No.
14. $325,556.19; water rights, $4,265.03.
15. Not easily increased.
16. None.
17. None.
18. None.
19. 250,000 gallons.
20. Sixty per cent.
21. 200 gallons estimated.
22. Twenty per cent.
23. One faucet, $8; each additional, $3; bath-tub, $6; each additional, $4; water-closet, $6; each additional, $4. Boarding-houses, one faucet, $15; each additional, $4. Private stables, one horse, $8; each additional horse, $4; one cow, $2. Measured water, 1,000 gallons, thirty to fifty cents, according to quantity.
24. Reservoir and direct pumping combined.
25. None of either.
26. Drains chiefly.
27. Merrimac River.

Peabody.

1. Peabody Water Works.
2. Spring Pond, Peabody and Lynn; Brown's Pond, Peabody and Lynn.

3. Sixty acres, Spring Pond; twenty-seven acres, Brown's Pond.
4. About 350 acres.
5. The land around both ponds is hilly.
6. 1,500,000 gallons.
8. Spring and Brown's Ponds are all the supply we have, and they are not connected with any other water supply.
9. No.
10. There is no other. We have claim to Humphrey's Pond Lynnfield, but have not as yet made the connection.
11. The danger is from highway and domestic drainage.
12. Yes.
14. $275,000, bought of Salem and Danvers Aqueduct Company.
15. It cannot be increased.
16. None.
17. None.
18. None.
19. 1,419,651 gallons.
20. No estimate.
21. Not estimated.
22. Large.
23. Dwelling-houses, six persons or less, $6; each additional person 50 cents; bath-tub and water-closet, $5 each; second bath-tub and water-closet, $3 each. Hotels and boarding-houses, each $15; with the addition of $2 per bed for every bed over six, not including bath-tubs or water-closets. Eating-houses, oyster saloons, refreshment-houses, confectioneries, market and fish stalls, $10 to $100; stores and shops, $6 to $25. Private stable, $4; and for each horse over one, $2; for each cow, $1.50. Livery stables, including water for washing carriages, for each horse, $2; no livery stable shall be charged less than $25; hose not more than three-eighths inch orifice, to be used by hand, limited to two hours in any one day, $3. Building purposes, for each cask of lime or cement, seven cents.
24. Gravity and stand pipe.
25. Total debt, $223,000; total amount of sinking fund, $6,840.05.
26. No system of drainage.
28. Not any.

Salem.

1. Salem Water Board.
2. Wenham Lake, in Wenham.
3. 320 acres.
4. 1,610 acres.
5. Wenham swamp, divided by gravelly soil.
6. 3,000,000 gallons daily.
7. No estimate.
8. No estimate.
9. None.
10. None.
11. None.
12. Prof. W. R. Nichols, in 1880: inorganic matter, 1.5 grains to

United States gallon; organic and volatile, 1.3 grains to United States gallon.

13. No.
14. Cost to Dec. 1, 1885, $1,423,783.48.
15. Can only be increased by raising dam, which would cause flowage.
16. None.
17. None.
18. None.
19. 2,579,605 gallons.
20. No data.
21. Same as above.
22. Very small.
23. Each family of four, $3; each additional person, 50 cents; water-closet or bath-tub, $5; hopper-closet, $8. Hotels and boarding-houses, each bed, $3. Private stable, $6; each horse over two, $3; each cow, $1. Measured water, 1,000 gallons, 13 to 20 cents, according to quantity.
24. Direct pumping and reservoir.
25. Water loan, $773,500; sinking fund, $172,549.94.
26. Flows into Ipswich River.
27. Ipswich Bay.
28. None.

Swampscott.

1. Swampscott. The town of Swampscott is supplied with water by the Lynn Water Company.

FRANKLIN COUNTY.

Greenfield.

1. Fire District Number One, Greenfield.
2. Glen Brook dammed to make pond, in the town of Leyden.
3. Five and one-quarter acres.
4. 452 miles.
5. Slate rock; steep hills.
6. No estimate.
7. 400,000 gallons.
8. No.
9. None.
10. Yes; Green River.
11. None.
12. No.
13. No.
14. $140,000.
15. 7,000,000 gallons, $1,000 cost.
16. No.
19. Approximately, 400,000 gallons.
20. Seventy-five per cent.
21. 375 gallons.
22. Five per cent.

23. $6 per year per family.
24. Gravity.
25. Over $95,000.
26. Sewers to Green River.
27. Green River to Connecticut River.
28. None at present.
29. Unknown.

Sunderland.

1. Sunderland Water Company.
2. Spring.
3. Large well, four feet square.
4. No estimate.
5. Conglomerate rock.
6. No estimate.
7. 600 barrels.
9. No.
11. None.
12. None.
14. $2,000.
15. It can be increased somewhat.
16. No.
19. Twenty families.
20. Forty per cent.
21. Fifteen barrels.
22. Ten to twenty per cent.
23. $7 to $15 per annum.
24. Gravity.
25. No debt.
26. Cesspools.

Montague.

1. Turner's Falls Company. No returns.

HAMPDEN COUNTY.

Agawam.

1. Agawam Water Works.
2. Springs.
5. Sandy plain.
11. None.
12. No.
13. Works are very small.
16. No.
25. No debt.
27. Agawam Run.

Chicopee.

1. Chicopee Water Company.
2. Dingle Brook; source in Springfield.
3. Area of reservoir, three and one-half acres.
4. Sandy plain, lying both east and west of the city.
5. Sandy plain, nearly level and underlaid by a bed of clay.

6. 250,000 gallons per day. The flow does not differ from this, except in wet weather.
7. It is a part of the watershed of the Chicopee River.
9. Yes; city of Springfield.
11. Drainage from farms.
12. No.
13. No.
14. $83,407.67, total cost.
15. Yes.
16. No.
17. No.
18. No.
19. 75,000 gallons.
23. Tariff of water rates per annum: Tenements occupied by one family, each tenement, $7; by two or more families, each family, $6; by one family, not more than three persons, $5; one bath-tub, $4; each additional bath-tub, $2; one water-closet, $4; each additional water-closet, $2; urinals, each, $2; private stable, each horse, $2; each cow, $2; stores, each, $4; offices, each, $2; saloons, each, $4; photograph galleries, each, $5; barbers' shops, each, $7; hose, with a nozzle not exceeding one-quarter of an inch orifice, $4.
24. Gravity.
25. None.
26. Sewers.
27. Chicopee and Connecticut Rivers.
28. None.
29. None.

Holyoke. 1.

1. Holyoke Water Works.
2. Ashley's and Wright's ponds, natural and contiguous mountain lakes in Holyoke, and Whiting Street Brook in Northampton.
3. Estimated at 230 acres.
4. 2,500 acres, approximately.
5. Trap rock. Long, narrow valley, running north and south, with abrupt hills on western side and hilly and rolling on eastern side.
6. 2,568,121 gallons per day from the ponds. The brook has not been measured.
7. No data.
8. No.
9. No.
10. Yes; small streams, three or four miles distant; cannot give area; watershed, etc.; also Connecticut River.
11. None other than from the swampy portions of ponds.
12. Yes; no figures given.
13. Yes; 35,000 land locked salmon.
14. Total cost to Dec. 31, 1885, $432,663.99; water rights, $4,644.13.
15. Yes; approximate cost, $50,000.
16. No.
17. No.

18. No.
19. Estimated 2,000,000 gallons.
20. Including stores, markets, saloons, offices, etc., about eighty per cent.
21. Estimated 300 gallons.
22. Cannot form any estimate.
23. Dwelling-houses, including tenement-houses, each family, $5; each boarder, 60 cents; each bath-tub or water-closet, $3; steam heating apparatus in dwelling-houses, $5; stores, $5; saloon or bar with faucet, $8; meat market, $10; fish market, $12; drug store, $8; charging soda fountains and soda fountain water jet, each, $5. Hotels, etc., each bed, $2. Private stables, each horse, $2; each cow, $1. Measured water, per 1,000 gallons, 5 to 15 cents, according to quantity.
24. Gravity.
25. Bonded debt, $250,000; sinking fund, Dec. 31, 1885, $75,890.93.
26. Sewers. Overflow from ponds discharged into brook.
27. Connecticut River.
28. None.
29. None.

Holyoke. 2.

1. Crystal Spring Aqueduct Company, Holyoke.
2. Springs located in Holyoke.
4. Limited. Exact area not known.
5. Foot hills of Mount Tom range.
6. 70,000 gallons.
7. 14,000 gallons.
8. Watershed used only by the subscribing company.
10. None.
11. The only danger arises from surface drainage.
12. None.
13. They have not.
14. Land was bought; no land taken. Total cost, $7,000.
15. Depend upon very limited storage. No increase of much extent necessary or desirable.
16. No.
17. None.
18. None.
19. No data.
20. Used only by families.
21. No data.
22. Possibly ten families.
23. $7 per year per family. All other rates same as the city of Holyoke rates.
24. Gravity.
25. None.
26. Through the natural channel from the springs.
28. No protection is at present required.

Springfield.

1. Springfield Water Works.
2. Ludlow Reservoir in Ludlow, surface water; Van Horn Reservoir in Springfield, surface water and springs.
3. Ludlow Reservoir, 445 acres; Van Horn Reservoir, 35 acres.
4. Ludlow Reservoir, 10.82 square miles.
5. Broken, rocky, woody country, with some cultivated land.
6. No estimate.
7. No estimate.
8. No.
9. Used only by city of Springfield.
10. None.
11. None.
12. No figures given.
13. The usual fresh water fish are present.
14. Total cost, Dec. 1, 1885, $1,306,187.47; water rights, $16,000.
15. Storage capacity, 2,000,000,000 gallons. No estimates have been made for any increase.
16. None.
17. None.
18. None.
19 104 gallons.
20. No data.
21. No data.
22. Five per cent.
23. Dwelling house, one family, $8; one water-closet, $4; each additional, $2; bath-tub, $4; each additional, $2. Stores, $4. Private stables, one horse, $4; each additional, $2.
24. Gravity.
25. $1,000,000, at 7 per cent.; $200,000, at 6 per cent. No sinking fund. First bonds due 1894.
26. Sewers.
27. Connecticut River.
28. None.
29. None.

Westfield.

1. Westfield Water Works.
2. Morse Meadow Brook in Montgomery.
3. Thirty-nine and one-fourth acres.
4. Estimated four and one-half square miles.
5. Rocky and mountainous.
6. 2,000,000 gallons.
7. 500,000 gallons.
8. Yes.
9. No.
10. Yes.
11. None.

12. Yes; Prof. R. W. Wood. Residue, 1.51 fixed, .23 volatile, 1.74 total.

SHEFFIELD LABORATORY, NEW HAVEN, CONN, July 2, 1874.

Hon. R. NOBLE, *Chairman of Water Commissioners, Westfield, Mass.*

SIR: — I have analyzed the sample of water from the Westfield Water Co., submitted for examination, and find it to be remarkably pure and free from such ingredients as are considered deleterious in a water supply. The solid matter contained in one gallon of the water amounts to only 1.51 grains. The organic matter does not exceed 0.23 of a grain. Nitrates and chlorides are especially to be feared in water which is to be served through lead pipes. As will be seen from the subjoined analysis, I have not been able to find nitrates in the water, and chlorides are present only to the extent of 0.15 of a grain per gallon.

Solid matter in one gallon of water of Westfield Water Co. expressed in grains:

Chloride of sodium,	.15
Sulphate of soda,	.06
Carbonate of soda,	.43
Carbonate of lime,	.32
Carbonate of magnesia,	.21
Silicic acid,	.34
	1.51

The organic matter amounts to about 0.23 of a grain per gallon. The total amount of solid inorganic and organic matter accordingly amounts to 1.74 grains per gallon.

13. No.
14. $256,443.68 total cost.
15. It can; approximate cost, $20,000.
16. No.
17. No.
18. No.
19. No data.
22 Very little.
23. Dwellings, $5 to $8, according to assessed value; stores, $5; meat and fish markets, $8; bath-tubs, $2; water-closets, $3. Private stables, one horse, $2; each additional, $1. Fire hydrants, maintained at private expense, free.
24. Gravity.
25. $240,000 amount of water bonds.
26. By overflow into bed of the brook.
27. Westfield River.
28. None.

West Springfield.

1. West Springfield Aqueduct Company.
2. Mountain brook.
3. Reservoir of one and one-half acres.
4. Estimated two miles by one and one-half mile.
5. Sandy soil.
6. Estimated 300,000 gallons.

7. No estimate.
8. No.
9. No.
10. Yes; but not defined.
11. None.
12. None.
13. Trout.
14. $75,000; damages, $5,000.
15. Cannot be increased.
16. No.
17. None.
18. None.
19. No estimate.
20. No estimate.
21. No estimate.
22. Very slight.
23. Dwelling-houses, $5 to $8; water-closet, $4; bath-tub, $4. Stores and offices each, $4. Livery stables, per stall, $2. Measured water, per 1,000 gallons, 22½ cents.
24. Gravity.
25. Bonded debt, $25,000.
26. Connecticut River.
28. None.

HAMPSHIRE COUNTY.

Amherst. 1.

1. Amherst Water Company.
2. Amethyst Brook, in Pelham.
3. Reservoir area, 50,536 feet; capacity in gallons, 2,730,390.
9. No.
10. Yes; within one-fourth of a mile.
11. None.
12. Prof. C. A. Goessmann, at Amherst; also by State Board of Health. *(See page 281.)*
13. No.
14. Cost, $70,000; water rights, $7,856.17.
15. Yes, $1,000; no damage.
16. No.
23. One family, $8; water-closet or bath-tub, $4; each additional, $2; offices, $2; stores, $4. Stables, one horse, $4; each additional, $2; cow, $2. Steam engines, per horse-power, $5.
24. Gravity.
25. $35,000; five per cent bonds.
27. Connecticut River.
28. None.

Amherst. 2.

1. Spring Water Company (Aqueduct Company), Amherst.
2. Pelham, Mass.
3. Several small wells or reservoirs.
4. No estimate.

5. Rocky.
6. Approximately, 6,000 to 10,000 gallons daily.
7. No estimate.
8. No; it comes from springs in hills.
9. Used part of the year by neighboring farmers.
10. The hills seem to be filled with springs belonging to the owners of the various farms.
11. None.
12. By State Board of Health. *(See page 281.)*
13. No.
14. $9,909.84. Water rights $550.
15. It would not be profitable.
16. No.
17. None.
18. None.
19. Not estimated.
20. Not estimated.
21. Not estimated.
22. Very small, if any.
23. Same as Springfield, Mass.
24. Gravity.
25. No debt or fund.
28. None.
29. None.

Northampton.

1. Northampton Water Works.
2. Roberts Meadow Brook, in towns of Chesterfield and Westhampton.
3. Two reservoirs,—the smaller area, 3 acres; the larger area, 5 to 6 acres.
4. Estimated 9¼ square miles.
5. Hills and valleys of granite, clay and soil.
6. The stream is subject to great fluctuations.
7. 450,000 gallons.
8. The brook supplies only Northampton Water Works.
9. See answer No. 8.
10. None.
11. The waters are carefully guarded from contamination.
12. Prof. Goessmann, in 1871.
13. No.
14. Cost of construction, $245,603.66; water rights, $20,000.
15. We depend not so much on storage, as upon the flow of the stream. We can store 25,000,000 gallons.
16. There is no such discharge, nor will it be allowed.
17. None.
18. See answer to No. 16.
19. 544,200 gallons estimated.
20. Ninety per cent.
21. 360 gallons, inclusive of mills.

22. Fifty families.

23. Dwellings, $5 to $7, according to value; bath-tubs, $2; water-closets, $2; each additional, $1; hopper-closets, four times the above rates; private hydrants, $3 to $5; markets, stores, bakeries, restaurants, etc., $7 to $10. Private stables, each horse, $2; each additional, $1; sheep, per 100, $6. Tobacco lands, per acre, $1. Measured water, 1,000 gallons, 15 to 20 cents, according to quantity. Fire hydrants, at private expense, free.

24. Gravity.

25. Debt, $200,000; sinking fund, $19,329.95.

26. Sewers and gutters.

27. Mill River.

28. None.

29. None.

South Hadley.

1. South Hadley Falls Water Works.
2. Buttery Brook, in South Hadley.
3. Reservoir, two acres.
4. Three square miles.
5. Sandy soil, three-fourths cultivated, one-fourth forest.
6. 150,000 gallons.
7. No.
8. No.
9. No.
10. Connecticut River.
11. None.
12. None.
13. Trout.
14. $60,000.
15. Can raise dam 2 to 3 feet at cost of $2,000.
16. No.
17. None.
18. None.
19. 150,000 gallons estimated.
20. Nearly all.

22. None.

23. One family, $8; markets and provision stores, $10; bath-tubs and closets, $2; garden hydrants, $3 to $5; one horse, $2; each additional horse, $1; sheep, per 100, $4; building purposes, 10 cents one cask of lime; fire hydrants, free.

24. Gravity.

26 Buttery Brook to Connecticut River.

MIDDLESEX COUNTY.

Arlington.

1. Arlington Water Works.
2. Great Meadows in East Lexington, and Sucker Brook.
3. Reservoir, 31 acres.
4. Four and one-half square miles.

5. Gravelly soil, hilly country.
6. No estimate.
7. No estimate.
8. No.
9. No.
10. None available.
11. None except East Lexington drainage.
12. None since the works started. An analysis was made before the works were built, by Prof. J. F. Babcock, no figures given.
13. No.
14. $305,949.74, total cost; $79,241.37 paid to mill owners, included in total cost.
15. No estimate.
16. Probably a very little drainage from East Lexington.
17. Small.
18. No apparent results.
19. No estimate.
20 No estimate.
21. No estimate.
22. No data.
23. One faucet, $6, each additional, $2; bath-tub or water-closet, $5; each additional, $3; for two faucets, one hot and one cold, in one basin, one charge only. Boarding-houses, one faucet, $10; each additional, $2; bath-tub or closet, $10; each additional, $3. Stores, offices, etc., one faucet, $5. Markets, saloons, etc., $5 to 25. Hotels, each bed, $3. Stables, one horse, $5; each additional, $4. Cask of lime, 6 cents.
24. Gravity.
25. $220,000, due Jan. 1, 1892; $80,000, due July 1, 1898.
26. Sucker Brook.
27. Mystic Pond (lower pond).
28. Nothing.
29. Nothing.

Cambridge.

1. Cambridge Water Works.
2. Stony Brook in Waltham, Weston and Lincoln; Fresh Pond in Cambridge.
3. Stony Brook, 72 acres when full; Fresh Pond, 188 acres when full.
4. Stony Brook, 20 square miles; Fresh Pond, 569 acres.
5. Stony Brook, steep hills and rocky; Fresh Pond, hilly, partly cultivated.
6. Stony Brook, 20,000,000 gallons; Fresh Pond, 2,000,000 gallons.
7. Stony Brook, 1,500,000 gallons; Fresh Pond, 600,000 gallons.
8. Part of the watershed of Charles River to the extent of 20 square miles.
9. No.
10. No.
11. Very slight.
12. Yes; Fresh Pond, by Prof. Wood; no figures given.

13. No.
14. $2,087,378.49; no water rights.
15. Stony Brook can be increased very considerably, but no estimate has been made of cost.
16. None.
17. None.
18. None.
19. 3,081,239 gallons.
20. Seventy-five per cent.
21. 185 gallons.
22. No data.
23. See printed schedule.
24. Stand pipe, direct pumping and reservoir.
25. Bonds, $1,747,500; sinking fund, $874,373.38.
26. Sewers.
27. Charles River.
28. None.
29. None.

Concord.

1. Concord Water Works.
2. Sandy Pond in Lincoln.
3. 153 acres.
4. 304 acres exclusive of water surface.
5. Rocky woodland, somewhat hilly; rock of trap formation mainly; small area of cleared land.
6. 400,000 to 500,000 gallons.
7. The storage capacity of the pond above the level of the conduit is sufficient to make the average daily flow available. The natural outlet, however, is sometimes dry for a few weeks or even months. Hence the minimum possible draught is small as average flow.
8. Part of the watershed of Stony Brook in Lincoln, Weston and Waltham, and hence in the water-shed of Charles River.
9. Lincoln, Mass. Organic matter and carbonic acid, 0.934; silica, 0.116; sulphuric acid, 0.385; chlorine, 0.097; calcium oxide (lime), 0.145; magnesium oxide, 0.065; alkalies, traces; total, 1.742 grains per United States gallon.
10. Magog Pond in Acton and Littleton was granted for additional supply April 30, 1884. Will require four miles of main pipe to connect with present works by gravity.
11. Very slight, from two or three private houses only within the limits of the watershed.
12. Prof. Goessmann; July, 1874.
13. By town of Lincoln.
14. $133,758.28; total cost of construction including land, rights, etc.
15. Can be increased at slight expense and with very small damage; but the present storage is ample.
16. No.
19. 350,000 gallons estimated daily consumption.
20. Sixty per cent.

21. 300 to 400 gallons estimated.
22. Two per cent. possible.
23. Hydrants, $15 each per annum.
24. Gravity.
25. Total, $122,500; amount of sinking fund, $8,827 69.
26. Cesspools, etc.
27. Concord and Assabet rivers.
28. None seems to be needed.
29. None.

Everett.

1. Everett.
2. Mystic Water of Boston.

Framingham.

1. Framingham Water Company.
2. Farm Pond and Sudbury River and filtering wells on shore Farm Pond.
4. 75 square miles.
5. See returns of Boston Water Board.
6. Wells about 800,000 gallons; for other capacities see returns Boston Water Board.
7. Wells about 300,000 gallons; see returns of Boston Water Board.
8. Yes; four artificial ponds in Framingham and Ashland, used by city of Boston.
9. City of Boston.
10. None of any value; see returns of city of Boston.
11. See returns of city of Boston.
12. No.
13. Yes; by town of Framingham.
14. Cost of works complete to July 1, 1886, $210,000; cost of water rights, $700 per year for each million gallons water used by Framingham per day, paid to Boston Water Board.
15. Farm Pond, no; Sudbury River, yes; see plan of Boston Water Board engineer.
16. None.
17. None.
18. None.
19. 260,000 gallons.
20. Twelve per cent.
21. 208 gallons.
22. Possibly 100 families.
23. Water rates, houses, one family, one faucet, $7.50; one water-closet, $5 (no pan closets allowed to be connected with the works); one bath-tub, $5. Houses, more than one family, each family one faucet, $[illegible]; one water-closet, $4; one bath-tub, $4. Hotels, boarding-houses and manufactories, one faucet, $15; one water-closet, $10; one bath-tub, $10. Hose for sprinkling, $8. Private stables, one horse, $5.
24. Direct pumping.
25. No sinking fund.

26. Cesspools and surface drainage.
27. Cannot tell.
28. None.
29. None.

Hudson.

1. Hudson Water Works.
2. Gates Pond in Berlin, Mass.
3. 70 acres.
4. 166 acres.
5. Rocky.
6. 250,000 gallons.
7. 106,000 gallons.
8. No.
9. No.
10. West Pond, about two and one-half miles north of Hudson.
11. None.
12. No.
13. Black bass, by town of Berlin.
14. $72,711.13, total cost of construction to May 1, 1886.
15. Storage capacity can be increased, but its relative capacity to the watershed would not warrant it.
16. No.
17. No.
18. No.
19. No data.
22. Twenty-five per cent.
23. Dwelling-houses, first faucet, $6; each additional one, $2; bath-tub, $5; water-closet, $5. Boarding-houses, for the first faucet, not exceeding ten persons, $10; each additional person, 75 cents. Stores, offices and warehouses, first faucet, $6. Markets, saloons, restaurants, workshops and greenhouses, $6 to $25. Private stables, first horse, $4; each additional horse, $2. Water rates, for domestic use only, per 1,000 gallons, 30 cents.
24. Gravity.
25. $73,000, water debt.
26. Surface drainage.
27. Assabet River.
28. None.
29. None.

Lexington.

1. Lexington Water Company.
2. Wells.
3. Two wells, 20 feet diameter by 30 deep.
7. 200,000 gallons.
8. Wells are situated some 300 feet from Vine Brook.
11. No.
12. No.

19. 30,000 gallons.
23. $8, first faucet.
24. Pumping.
25. $20,000, bonds; sinking fund, $1,050.

Lincoln.

1. Lincoln Water Works.
2. Sandy Pond, Lincoln, Mass.
3. 152 acres.
4. 300 acres, estimated.
9. Concord.
11. No immediate danger.
13. Black bass.
14. $35,000, total.
15. Not easily.
16. No.
24. Pumping.
25. Debt, $30,000; sinking fund, $1,300.
26. Surface drainage.
27. Stony Brook and Charles River.

Lowell.

1. Lowell Water Works.
2. Merrimac River.
3. No estimate.
4. 4,093 square miles.
5. Gravel and granite.
6. No data.
7. 2,332,800,000 gallons, dry season.
8. None for domestic purposes above Lowell.
9. By the Locks and Canals Company as a source of motive power.
10. None of sufficient capacity.
11. Nashua and Manchester, N. H., and paper mills on the Nashua River.
12. By the State Board of Health, and Prof. Nichols; no figures given.
13. Efforts have been made to stock the Merrimac River with salmon, with but little success.
14. Gross cost of works to Jan. 1, 1885, $3,746,015.55; net cost of works to Jan. 1, 1885, $2,370,294.37.
15. None required.
16. Nashua and Manchester, N. H.
19. Forty-three gallons.
22. Very little.
23. Annual rates are—for apothecaries, $10; aquaria, $3; bakeries, for average daily use of flour for each barrel the sum of $3 per annum; provided that in no case shall any bakery be charged less than $6; public baths, and for each bath in any hotel, $10; water-closets in public houses, $10; hose, $3; urinal, $3; club rooms, $3 to $20; dwellings

'or a family not exceeding six persons, $6; families of more than six persons shall pay for each person above six, 50 cents; the fixtures allowed, in constant use, under the foregoing family rates, shall be one hot and one cold water faucet at two sinks, and two set wash basins; all sinks, more than two, shall be assessed, each sink, $1; all basins, more than two, shall be assessed, each basin, 50 cents; water-closets in dwellings, stores and shops shall be assessed, for each person residing on the premises, 50 cents; provided no water-closet shall be assessed less than $4; each additional water-closet, $2; bath-tubs in dwellings or tenements shall be assessed, for each person residing in such dwelling or tenement, 50 cents; provided no bath-tub shall be assessed less than $3 or more than $8; each additional bath-tub, $1; set wash-tubs in dwellings, if supplied with city water by faucet, hose or spout, shall be assessed for each tub, $1; in ascertaining the number of persons as a basis for assessments, children, servants and lodgers shall be counted; fish markets, $6 to $15; fountains, private, each, $3 to $10; portable fountains, each, $3; the right to attach hose of not more than five-eighths of an inch orifice, for washing windows and sprinkling streets or gardens, per year or fractional part thereof, $3; hotels, for each bed, $3.50; meat markets, $6 to $15.

24. Reservoir.
25. Water debt, $1,890,000; sinking fund, $511,557.96.
26. Sewers.
27. Merrimac River below intake.
28. Analysis does not indicate any danger as yet.

Malden.

1. Malden Water Works.
2. Spot Pond, in Stoneham.
3. 295 acres.
4. About 1,100 acres.
5. Rocky woodland.
6. No data.
7. No data.
8. No.
9. Melrose and Medford.
11. None.
12.

BOSTON, May 3, 1879.

Malden Water Board.

GENTLEMEN: — I have made chemical and microscopical analyses of a sample of Spot Pond water, received from you, with the following results: The total weight of all the solid matters in one United States gallon of this water does not exceed four grains; and the proportions of ammonia and chlorides are very small, and not more than are present in pure pond waters generally. The impurity in this sample consists of a growing and decaying (*confervoid*) vegetable matter, that is quite common at this season of the year in nearly all pond waters. Although it weighs very little, the quantity is larger than usual in this case, and sufficient to impart color, odor and taste to the water. It is not a poi-

sonous or deleterious substance, although it is offensive, and if permitted to increase in quantity it will become a source of annoyance to your community, by accumulating in the street pipes in places where the current is sluggish, and by its appearance in the water as it is drawn from the faucets. I think there must be an excessively large growth of vegetation in your pond, that should certainly be removed as soon as is practicable. Excepting the presence of this vegetable matter, this water is remarkably pure. Respectfully,

S. DANA HAYES,
State Assayer, Massachusetts.

13. Black bass, by town of Stoneham.
14. Cost of water works to Jan. 1, 1886, $135,598.94. See report.
15. No data.
16. No.
24. Gravity.
25. Sinking fund, $100,380.10.
56. Malden River.
27. Atlantic Ocean.
28. None.

Marlborough.

1. Marlborough Water Works.
2. Lake Williams.
3. 72 acres.
4. 219 acres.
5. Rolling tillage land.
6. 300,000 gallons.
7. 200,000 gallons.
8. No.
9. No.
10. White Pond in Sudbury and Stow, 200 acres; 800 acres watershed, pumped five miles.
11. A few dwellings.
13. No.
14. $214,673.86, total cost; $6,450, water rights.
15. Can be increased for $200; cannot estimate damage.
16. No.
19. 172,039 gallons.
20. Ninety-three and one-half per cent.
21. 110 gallons.
22. Ten per cent.
24. Reservoir and direct pumping.
25. $8,300.40, sinking fund.
26. Percolation.
28. An intercepting sewer around the lake.
29. Estimated cost, $5,000.

Medford.

1. Medford Water Works.
2. Spot Pond, in Stoneham.

3. See Malden.
4. 1,100 acres.
5. Mostly farming land.
8. No.
9. City of Malden and Melrose.
12. See Malden.
14. $33,171.25, land damages; $308,526.01, construction; $64,124.86, maintenance.
15. No.
16. No.
24. Gravity.
25. Debt, $300,000; sinking fund, $59,097.44.

Melrose.

1. Melrose Water Works.
2. Spot Pond, in Stoneham.
3. 295 acres.
4. 1,100 acres.
5. Woodland, rocky.
8. None.
9. Malden and Melrose.
11. None.
12. See Malden.
13. Black bass, by town of Stoneham.
14. Cost of works to Jan. 1, 1885, $189,441.98.
16. None.
19. No estimate.
23. One faucet, $6; each additional, $2; water-closet, $5; each additional, $3.
24. Gravity.
25. $150,000, debt; $24,515.60, sinking fund.
26. Malden River.

Natick.

1. Natick Water Works.
2. Dug Pond.
3. Forty-four and one-half acres.
4. Small, being mainly from springs.
5. Gravel and hilly.
8. No.
9. No.
10. None.
11. Sewerage of Natick.
12. No.
13. Yes.
14. $224,140.70; no water rights.
15. Yes; no damage except flowage.
16. No.
17. 8,500, mostly boot and shoe manufacturers.
19. 235,758 gallons.

20. 41 gallons.
21. 192 gallons.
22. No estimate.
23. Dwelling-houses, first faucet, $6; each additional faucet, $2; water-closet, $6; bath-tub, $5. For a private family the rate for the following fixtures will not be more than $22 per year, namely, one bath-tub, one water-closet, and not more than eight faucets. Boarding houses, consisting of five or more boarders, for first faucet, $10; for each additional faucet, $2; for water-closet or bath-tub when used for boarders, $10. Stores occupied as offices, shops or similar purposes and requiring no more than an ordinary supply of water, for the first faucet, $6; for each additional faucet, $2. Private stables, for each horse, $2.50; for first cow, $2; for each additional cow, $1. Livery and boarding stables, for each horse, $2.50.
24. Reservoir and direct pumping.
25. Debt, $136,000; sinking fund, $10,000.
26. Two eighteen inch waste pipes.
27. Lake Cochituate.

Newton.

1. Newton Water Works.
2. Through a filtering gallery on the banks of the Charles River, located in Needham.
3. No data.
4. No figures given.
5. Glacial deposit over primary rock. Slope gradual to the Charles River.
6. From gallery about 1,100,000 gallons per twenty-four hours. From river, do not know, but we are allowed 1,500,000 gallons per day by charter.
7. From gallery, 1,100,000 gallons.
8. We don't know.
9. From the river, which certainly partly supplies us, and its tributaries, Dedham, Brookline, Wellesley, Waltham, and Watertown are supplied.
10. Hammond and Baptist Ponds in Newton, but they are too small to be of much value; they are from two to four miles from our pumping station.
11. Very little at present above us.
12. August, 1885, by Prof. E. S. Wood, Harvard Medical School. Unfiltered — free ammo., .0002; alb. ammo., .0006. Chlorine, 0.40. Residue — fixed, 2.30; volatile, 1.70; total, 4.00. Hardness, 1°.
13. No.
14. Net cost of works to Jan. 1, 1886, $399,315.72. This amount includes $25,000 paid to mill owners for right to take 1,500,000 gallons daily from the river.
15. No data.
16. Not that we are aware of.
19. Year 1885, 615,000 gallons.

20. Eighty per cent.
21. 162 gallons.
22. Ten per cent.
23. One faucet, $6; each additional, $2; bath-tub, $5; each additional, $3; water-closet or urinal, $5; each additional, $3. Boarding houses, same rates as above. Hotels, each bed, $3; bath-tubs, water-closets and urinals, double rates. Private stables, one horse, $5; each additional, $3. Cask of lime, each, 6 cents. Measured water, 100 gallons, 3½ cents; special rates to markets, factories, railroads, etc., etc.
24. Direct pumping into street main and surplus goes to reservoir.
25. $169,072.30 sinking fund.
26. Cesspools.
27. Charles River.
28. Restraint of factories and houses from discharging sewage into the river.
29. None at present.

Somerville.

1. Somerville, supplied by Boston.

Wakefield.

1. Wakefield Water Company. (Supplies towns of Stoneham and Wakefield.)
2. Crystal Lake, Wakefield.
3. About 96 acres of lake or pond.
4. One mile.
6. Not estimated.
7. Not estimated.
8. No.
9. No.
10. No.
11. None.
12. Prof. S. P. Sharples, in 1876. (*See page 281.*)
13. Yes.
14. Not yet decided.
15. No.
16. No.
19. About 350,000 gallons.
20. No data.
21. No data.
22. No data.
23. $6 to $5 per family.
24. Direct pumping and stand pipe.
26. Saugus River.
27. Saugus River.
28. None.

Waltham.

1. Waltham Water Works.
2. Filter basin dug near the north bank of the Charles River.

3. One-fourth acre.
5. Hilly. Gravelly drift with boulders, underlaid by a tenacious clayey soil.
6. See answer to number 19.
10. Probably not.
11. Domestic drainage.
12. February, 1872, by Prof. Nichols; no figures given.
13. Black bass.
14. $361,000, total cost to Jan. 1, 1886, including $9,609.50 damage to mill owners.
15. Yes.
16. No.
19. 529,362 gallons.
20. Ninety per cent.
21. 200 gallons.
22. Five per cent.
23. One faucet, $6; each additional, $2; bath-tub, $5; each additional, $3; water closet, $5; each additional, $3; urinal, $2. Boarding-houses, one faucet, $10; each additional, $2; bath-tub or closet, $10; each additional, $3. Hotels, each bed, $1. Markets, saloons, restaurants, etc., $6 to $25. Private stables, one horse, $5; each additional, $2. Cask of lime, 6 cents. Measured water, 100 gallons, 3 cents.
24. Reservoir and direct pumping.
25. $346,000 in bonds at six per cent., four and one-half per cent. and four per cent.; $6,617.80, sinking fund.
26. Vaults and cesspools.
27. Charles River.
28. The water board recommend the purchase of 40 or 50 acres of adjoining land.
29. No estimate.

Watertown.

1. Watertown Water Supply Company.
2. Wells near Charles River in Watertown.
3. 3,250 feet.
4. No estimate.
5. Gravel, apparently full of water.
6. 1,000,000 gallons.
7. No data.
8. None.
9. No.
10. Charles River and a few small ponds.
11. None.
12. April 7, 1885, by Prof. E. S. Wood; no figures given.
13. No.
14. Approximate cost, $200,000.
15. Can be increased at small cost.
16. No
19. 130,000 gallons.

20. Ninety per cent.
21. No data.
22. Fifteen per cent.
23. Dwelling-houses, $ 4 to $6 per family; bath-tub and water-closets, $5 each. Boarding-houses, first faucet, $10; each additional faucet, 3. Stores, $6 to $20. Private stables, for first horse, $5; each additional horse, $2; cow, $1. Building purposes, for every cask of lime, cents.
24. Stand pipe.
25. No sinking fund.
26. Cesspools and Charles River.
27. Charles River.
28. None.

Wayland.

1. Wayland Water Works.
2. Head of Snake Brook, a tributary of Lake Cochituate.
3. Thirteen acres.
9. The water that flows over our dam runs into Snake Brook to Lake Cochituate.
10. None.
11. None.
12. By Prof. Nichols; no figures given.
13. No.
14. $29,000, total cost; $2,250, water rights.
15. It can be increased, at an estimated cost of $5,000.
16. No.
24. Gravity.
25. $25,000 in five per cent. bonds; $4,000 in four per cent. bonds. Sinking fund established.
27. Lake Cochituate.
28. None.

Winchester.

1. Highland Water Works, Winchester, Mass.
2. Artificial reservoir.
3. 63 acres.
4. About 460 acres.
5. Hilly woodland and ledge.
6. No data.
7. No data.
8. Is not.
9. None.
10. None.
11. None.
12. (*See page 281.*)
13. Yes, by water board.
14. $175,000.
15. Cannot.
16. Not directly.

19. 500,000 gallons.
20. Four and one-half per cent.
21. 250 gallons.
22. 7,500 gallons.
24 Gravity.
25. Provided for by yearly payments.
26. By overflow.
27. Mystic Pond.
28. None.

Woburn.

1. Woburn Water Works.
2. Filtering well on border of Horn Pond; also water of pond if necessary.
3 Area of well, 984 square feet; pond, 103 acres.
4. 4,700 acres.
5. Uneven and hilly surface.
6. Capacity of well, 1,250,000 gallons. No water as yet drawn from pond.
7. No data.
8. Winter Pond, Wedge Pond and Mystic Pond.
9. No.
10. No.
11. None.
12. Prof. C. T. Jackson, 1873.
13. Yes. Fish Commissioners; black bass and salmon.
14. Total cost, $527,903.60.
15. Could be increased at cost of $5,000 dollars. No estimate of damages.
16. No.
17. None.
18. None.
19. 623,489 gallons.
20. Sixty-six per cent., estimated.
21. 207 gallons.
22. Five per cent.
23. One faucet, $6; each additional, $2; bath-tub or water-closet, $5; each additional, $3. Boarding-houses, one faucet, $10; each additional, $2. Public baths, one tub, $10; each additional, $5. Stables, one horse $5; each additional, $3. Markets and restaurants, $5 and upward. Each cask of lime, 6 cents. Measured water, 100 gallons, 1¼ to 2 cents.
24. Direct pumping and reservoir.
25. Debt, $466,300; sinking fund, $130,658.64.
26. Cesspools.
27. Abajona River.
28. Drainage should be excluded from Horn Pond entirely.

NANTUCKET COUNTY.

Nantucket.

1. Wannacomet Water Company, of Nantucket.
2. Wannacomet Pond, 2 miles west of town.
3. 8 acres.
4. Not surveyed.
5. Low hills, light soil.
6. Unknown.
8. No.
9. No.
10. Maxcy's Pond and north head of Hummock Pond. Maxcy's Pond is one-fourth mile south-west of Wannacomet Pond. All inside 3 miles of town.
11. None.
12. (*See page 281.*)
13. Black bass.
15. No more water is available.
16. None.
19. 58,000.
20. Unknown.
22. Ten per cent.
24. Receiving tank and occasional direct pumping.
26. Cesspools and gutters.
28. None.

NORFOLK COUNTY.

Brookline.

1. Brookline Water Works.
2. Filtering galleries on the banks of Charles River in West Roxbury.
3. Galleries, 1,161 in length.
4. Not estimated.
5. Glacial, ridges, undulating and some meadow.
6. Not estimated.
7. 1,000,000 gallons per day.
8. Charles River.
9. Not at this point on the river.
10. Probably by extending our galleries across the river, and also along the banks.
11. At present none. We fear sewerage from above on the river or from washing skins.
12. Not since last report to the State Board.
13. Yes.
14. $749,474.56 cost.
15. Need no further storage.
16. Yes; Dedham and perhaps Needham.
17. See other returns.

18. None is apparent either by taste, smell or color.
19. 665,292 gallons daily.
20. 90 per cent.
21. 362 gallons.
22. 8 per cent.
24. Pumping into reservoir.
25. Water scrip outstanding, $681,000.
26. Sewers.
27. Through Muddy River to Charles River basin.
28. To put an end to sewerage into the river above our works and forbid sheepskin washing on the banks.
29. To the towns referred to.

Dedham.

1. Dedham Water Company.
2. Charles River or well contiguous.
3. Well, 25 feet in diameter, 18 feet deep.
4. No data.
5. Gravel. Well, 600,000 gallons per day.
7. Charles River daily flow past well, estimated at 20,000,000 to 30,000,000 daily.
8. Yes.
9. Charles River is used by Wellesley, Newton, Brookline, Waltham and Watertown.
10. Wigwam Pond one mile away; would require new pumping works.
11. Apparently none.
12. Prof. E. S. Wood; no figures given.
13. None in well.
14. $135,000; $5,100 paid to Charles River mill owners.
16. None.
18. None.
19. 130,000 gallons.
20. 100,000 gallons.
21. 150 to 200 gallons.
22. 40 or 50 new takers.
23. One faucet, $6; each additional, $2; bath-tub or water-closet, $5 ... $5; each additional, $2. Boarding-houses, one faucet, $10; one bath-tub, $10; one water-closet, $10. Private stable, first horse, $5; each additional, $2. Measured water at special rates. Building purposes, each cask of lime, 6 cents.
24. Stand pipe.
25. $35,000 in 5 per cent. bonds.
26. Cesspools.
27. Charles River or Neponset River.
28. None.
29. None.

Franklin.

1. Franklin Water Company.
2. Well and Beaver Pond.
3. Pond about 30 acres; well 20 feet across.
8. No.
9. No.
11. None.
12. No.
13. No.
14. $75,000.
15. None.
16. No.
19. 35,000 gallons.
20. No estimate.
21. No estimate.
22. 35,000 gallons.
23. $8 per family.
24. Stand pipe.
25. None.
28. None.

Norwood

1. Norwood Water Works.
2. Buckminster Pond, West Dedham.
3. 29.5 acres.
4. 250 acres.
5. Ranges of rocky hills.
6. 300,000 gallons.
7. Some seasons of the year there is no overflow.
8. No.
9. No.
10. Foundry Brook, which has a watershed of 400 to 500 acres, capable of supplying 500,000 gallons per day. Can be connected by pipe, being 11 feet higher.
11. None.
12. Yes; no figures given.
13. Yes.
14. $80,705.11, cost.
15. Cost, $5,000; damages, $1,000.
16. None.
17. None.
18. None.
19. Works still incomplete.
20. All at present.
21. No data.
22. No data.
23. Family, $6; bath-tub, $5; water-closet, $5; for each additional faucet, $2. Boarding-houses, first faucet, $10; for each additional faucet, $3; bath-tub, $10; water-closet, $10. Stables, first horse, $5; each

additional horse, $2. First cow, $2; each additional cow, $1. Hose for sprinkling premises and streets in front, nozzle not to exceed one-fourth inch in diameter and use limited to two hours per day, $5. Building purposes, for each cask of lime or cement, 6 cents. Measured water, minimum annual rate shall in no case be less than $10.

24. Direct pumping.
25. $75,000 bonds.
26. Surface drains.
27. Neponset River.
28. None.
29. Whoever might be the cause of any impurity.

Quincy.

1. Quincy Water Company.
2. Well.
3. 28 feet deep, 30 feet diameter.
4. 5 to 6 square miles.
5. Mostly pasture land with light soil and gravel; very little cultivated land.
6. 5,000,000 gallons with suitable storage basins.
7. No estimate.
8. None.
9. No.
10. Blue Hill River, 1 mile, located in Braintree and Milton; could connect by open trench.
11. None.
12. Prof. S. P. Sharples, 1884.
13. No.
14. $265,000 net cost.
15. No data.
16. No.
19. 250,000 gallons.
20. Seventy per cent.
21. 250 gallons.
22. 50,000 per day.
23. Houses occupied by one family, one faucet at sink or basin, $7.50; each additional faucet, $2.50; one water-closet, $5; each additional, $2; one bath-tub, $5; each additional, $2; one urinal $3; each additional, $1. Houses occupied by more than one family, each, one faucet at sink or basin, $5; each additional faucet, $2; one water-closet, $[illegible] each additional, $2; one bath-tub, $4; each additional, $2; one urinal, $2; each additional, $1. Hotels, boarding-houses and manufactories, one faucet at sink or basin, $10; each additional faucet, $3; one water-closet, $10; each additional, $3; one bath-tub, $10; each additional, $3; one urinal, $5; each additional, $2. Private stables, hose for carriage washing, $5; one horse, $5; each additional, $2. Livery and boarding stables, hose for carriage washing, $20; each additional horse, $1. General use, hose for sprinkling, $10. Meter rates, 500 gallons or less, per day, 30 cents per 1,000 gallons; 500 to 1,000 gallons per day,

25 cents; 1,000 to 2,000 gallons per day, 20 cents; 2,000 to 5,000 gallons per day, 15 cents; 5,000 gallons and over per day, 12½ cents. The company will set meters and charge meter rates whenever they consider it for their interest to so do.

24. Stand pipe and pumping.
25. $250,000.
26. Surface drainage and cesspools.
27. Quincy Bay.

Sharon.

1. Sharon Water Company.
2. A well near Beaver Brook Meadow; brook in Sharon.
3. Sixteen feet square.
4. No data.
6. 290,000.
7. Very even.
8. No.
9. None.
10. Beaver Meadow Brook, Massapoag Pond, Wolomolopoag Pond.
11. None.
12. Prof. E. S. Wood.
13. No.
14. $40,000.
15. Yes.
16. None.
17. None.
18. None.
19. No data.
20. Ninety per cent.
21. 100 gallons.
22. Double.
23. $7, one faucet.
24. Stand pipe.
25. $20,000 bonds.
26. Cesspools and surface drainage.
27. Neponset River.
28. None.
29. None.

Wellesley.

1. Wellesley Water Works.
2. Filtering wells near banks of Charles River and Longfellow's Brook.
3. Filtering well with an area of about 150,037 feet.
4. 3,000 acres estimated.
5. Gravel and sand.
6. Filtering well, 100,000 gallons daily; brook, 3,000,000 gallons per day.
7. Brook, 1,000,000; filtering well, 100,000, uniform flow.
8. No.
9. No.

10. Several other sources.
11. None.
12. Prof. S. P. Sharples, in December, 1884. Free ammonia, unfiltered, .012; albuminoid ammonia, unfiltered, .009; residue, fixed, 6.00; residue, volatile, 1.25; total, 7.25.
13. No.
14. $140,000 total cost.
16. None.
19. 60,000 gallons.
20. All used by families.
21. 300 gallons.
22. Fifty per cent.
23. Family, $6; bath-tub, $5; water-closets, $5. Stables, one horse, $5; one cow, $1.50. Cask of lime or cement, 5 cents. Measured water, per 1,000 gallons, 25 cents.
24. Reservoir.
25. Funded debt; sinking fund, $3,000.
26. Cesspools.
28. None.

PLYMOUTH COUNTY.

Brockton.

1. Brockton Water Works.
2. Salisbury River, Stoughton, Mass.
3. Ninety acres.
4. Three and one-quarter miles.
5. Rocky and hilly.
6. No data.
7. No data.
8. None.
9. None.
10. Probably not.
11. None. Ninety per cent. of the water-shed is wild and uncultivated land.
12. Yes; no figures given.
13. No.
14. $362,360.64, cost; $27,308.08, water rights.
15. Yes.
16. None.
17. None.
18. None.
19. No data.
20. Seventy-five per cent.
21. No data.
22. Ten per cent.
23. $5 per faucet; 30 cents per 1,000 gallons.
24. Gravity.
25. $305,000, debt; $35,101.74, sinking fund.
27. Taunton River.
28. None.
29. None.

Hingham.

1. Hingham Water Company.
2. Accord Pond in Hingham, South Scituate, and Rockland; Fulling Mill Pond in Hingham.
3. Accord Pond, 366 acres; Fulling Mill Pond, 12 acres.
4. Accord Pond, 366 acres.
5. Disintegrated primitive rock, undulating woodland and pasture, small area cultivated.
6. Accord Pond, 600,000 gallons; Fulling Mill Pond not estimated.
8. No.
9. No.
11. Not much of any.
12. Yes; in 1874 and 1885, by Prof. W. R. Nichols; no figures given.
13. Yes.
14. Total cost, $237,500; rights and damages, $8,300.
15. Yes; but no estimate of the cost has been made.
16. None.
17. None.
18. None.
19. No data.
20. No data.
21. No data.
22. No data.
23. $8 and $10 a family in Hingham; $10 and $12½ a family in Hull.
24. By gravity in Hingham; stand pipe and direct pumping in Hull.
25. Debt, $100,000.
26. By a brook running through Hingham.
27. Weir River.
28. None.

Kingston.

1. Kingston Aqueduct Company.
2. Cuff Springs.
7. 100,000 gallons.
14. $5,000.
19. 10,000 gallons.
20. No estimate.
23. $1.50 per person per year.
24. Reservoir.
27. Jones River.
28. None.

Middleborough.

1. Middleborough Water Works.
2. A collecting well 26 feet diameter, near the Nemasket River.
3. 531 feet.
4. 15,000 acres.
5. Sandy soil and porous gravel. No very high elevations. The 15,000 acres watershed includes 6,000 acres of lakes.

6. The well will supply approximately 1,500,000 gallons per day; no estimate of average flow of river.

7. No estimate.

8. As noted above, there are about 6,000 acres in our watershed, all of which flow through the Nemasket River which flows alongside our pumping station.

9. None. The charters of the Taunton and the New Bedford Water Works give them rights in the lakes.

10. Assowompsett Pond, 2,200 acres long; Quittacus and Pocksha connecting with Assowompsett Pond. Could connect by taking water direct from the river or by laying a conduit direct to the ponds.

11. None.

12. Prof. E. S. Wood, April, 1886. Unfiltered — Ammo., .0004; alb. ammo., .0010. Chlorine, 1.20. Residue — Fixed, 4.00; volatile, 3.90; total, 7.90. Hardness, 4. Transparency, clear; color, none; odor, none; no blackening on ignition; nitrates, absent. An excellent water.

13. Black bass.

14. $71,620.98.

15. By digging more wells.

16. None.

19. 40,000 to 60,000 gallons.

20. Seventy-five to eighty per cent.

22. Fifty to one hundred per cent.

24. Stand pipe.

25. $70,000; no sinking fund.

26. Sewers and cesspools.

27. Nemasket River.

28. Nothing at present.

Plymouth.

1. Plymouth Water Works.

2. Great and Little South Pond, Boot Pond and Patuxet Lake.

3. 464 acres; ponds.

4. 600 acres.

5. Sand and gravel; hills wooded with oak and pine.

6. Estimated 2,000,000 gallons daily.

7. Varies but little.

8. None.

9. None.

10. "Billington Sea" in Plymouth, 300 acres. Watershed 800 to 1,500 acres, by a canal 500 feet long connecting it with Patuxet Lake.

11. None.

12. Prof. W. R. Nichols.

13. Black bass.

14. Water rights, $20,000; cost, $140,000; total, $160,000.

15. Not estimated.

16. None.

17. None.

18. None.

19. 450,000 gallons.
20. Sixty-seven per cent.
21. 490 gallons.
23. For family use, $5 to $11.
24. Pumping, with reservoir for night supply.
25. Bonded, $70,000 at four per cent.; $20,000 at six per cent.
26. By artificial canal.
27. Plymouth Harbor.
28. None desired.

Rockland.

1. Rockland Water Company, April 1, 1886. Our water supply is not yet in operation, having just commenced trenches for pipes.

Whitman.

1. South Abington Water Supply Company.
2. Hobart's Pond.
3. 250 acres.
4. Stream rises about seven miles away from the town.
6. Ample supply.
7. Not estimated.
8. The same water-shed supplies one other pond.
9. No.
10. None.
11. Vegetable growth.
12. Prof. E. S. Wood in 1882; figures not stated.
13. No.
14. $58,194.46.
15. The storage capacity is ample; would not be practicable to increase, otherwise than by dredging to make deeper.
16. No sewerage, but more or less drainage.
17. About 4,000.
19. 32,191.
20. Thirty per cent.
21. 64 gallons.
22. Fifteen per cent.
24. Stand pipe.
25. $55,000; sinking fund, $2,000.
26. No provision made for it.
27. None.
28. Against vegetable.

SUFFOLK COUNTY.

Boston.

1. Boston.
2. Lake Cochituate, Sudbury River and Mystic Lake.
3. Total area of storage reservoirs, 1,735 acres.
4. Lake Cochituate, 12,077 acres; Sudbury River, 76.3 square miles; Mystic Lake, 17,200 acres.
6. Cochituate, 19,000,000 gallons; Sudbury River, 74,000,000; Mystic, 22,700,000.
7. Cochituate, 10,000,000; Sudbury River, 25,000,000; Mystic, 7,000,000.

NOTE: These are the amounts which these works may be depended upon to furnish in a year of drought.

8. No.
9. Natick and Wayland take their supplies from the Cochituate watershed; Framingham and Westborough, from the Sudbury River watershed; Woburn, Winchester, Somerville, Chelsea, and Everett, from the Mystic watershed.
10. Shawsheen, Charles River; Concord River.
11. Sewerage of Woburn, Winchester, Stoneham, Framingham, Natick and other towns in the water sheds.
12. Yes; Prof. E. S. Wood; records in this office.
13. Chestnut Hill and Lake Cochituate with black bass.
14. Cost of Cochituate Works to March 1, 1886, $18,683,726.36; of Mystic Works to March 1, 1886, $1,656,843.82; total, $20,340,570.18.
15. The storage capacity of the Sudbury River and Mystic Works can be somewhat increased; cost not known.
16. Yes.
17. Mystic, say 20,000, leather and other industries; Cochituate, say 20,000, cotton industries chiefly.
18. Not well defined.
19. 32,344,550 gallons or 71.2 gallons per head.
20. Not known.
21. Not known.
22. Not known.
23. Dwelling-houses, valued at less than $1,000, $6; for every additional $1,000 of valuation up to $25,000, $1; for every family more than one in a house, $2; water-closet or bath-tub, $5. Tenement houses, $3; and for each $100 or fraction of $100 rent above $300, 50 cents. Stores and offices, sink or bowl, $5; each additional, $2.50; water-closet, $5. Restaurants, saloons, photographers, etc., according to amount used, $5 to $50. Hotels, each bed, $3. Bakeries, for each daily barrel of flour, per annum, $3. Private stables, $6; each horse over two, $2. Livery stables, each horse, $2. Omnibus stables, each horse, $1.50. Truckmen's stable, each horse, $1.25. Hand-hose, with nozzle not exceeding three-sixteenths inch diameter, to be used on the premises of the water taker only, for the season, $5. Lawn sprinklers are strictly prohibited except where meters are used.

24. Sudbury and Cochituate Works supply Low Service Works by gravity; and High Service, by pumping to reservoir. Mystic Works supply by pumping to reservoir.

25. Cochituate water debt, March 1, 1886, $13,325,473.98; Cochituate water sinking fund, March 1, 1886, $3,331,987.54; Mystic water debt, March 1, 1886, $839,000; Mystic water sinking fund, March 1, 1886, $518,864.94.

26. Sewers.

27. Atlantic Ocean.

28. Systems of drainage for towns of Mystic Valley, Natick, Framingham, Westborough and Marlborough.

29. See report of Drainage Commission, 1885.

Chelsea.

(No returns. Supplied from Mystic Works.)

Revere.

(No returns.)

Winthrop.

1. Winthrop Water Company, established by Acts of 1884. The town of Winthrop is supplied with water by the Revere Water Company.

WORCESTER COUNTY.

Athol.

1. Athol Water Company.
2. Thousand-acre Meadow Brook in Phillipston.
3. 20 acres reservoir.
4. One and one-half square miles.
5. Pasture and farming lands.
6. 250,000 gallons.
7. 150,000 gallons.
8. No.
9. No.
10. Golden Pond in Petersham; fine source of supply of beautiful water whose average daily flow is estimated at 500,000 gallons and does not change its character during the summer months; 4½ miles from present source of supply; watershed 3 miles square.
12. Yes; State Board of Health and Prof. Leeds of Stevens Institute, Hoboken, N. J.; no figures given. (*See page 281.*)
13. Yes.
14. $125,000, approximate cost; $2,000, water rights.
15. No.
16. No.
19. 250,000 gallons.
20. All.
21. No data.
22. Nothing.
24. Gravity.

25. $70,000 in bonds.
26. Surface drainage.
27. Miller's River.
28. Against cucumber smell and taste during the summer months.

Clinton.

1. Clinton Water Works.
2. Spring Stream in Sterling.
3. Two and five-eighths acres.
4. 16,000 acres.
5. Abrupt hills of granite and slate rock; covered mostly with drift; very little meadow.
6. 1,500,000 gallons.
7. 400,000 gallons.
8. No.
9. No.
10. No.
11. None.
12. No.
13. No.
14. $260,000.
15. Yes.
16. No.
19. 250,000 gallons.
20. No data.
24. Gravity.
25. $248,000, four per cent bonds; $5,000, sinking fund.
26. Drains and cesspools.
27. Nashua River.
28. No protection needed.

Fitchburg.

1. Fitchburg Water Company.
2. Scott, Overlook and Falulah reservoirs.
3. Scott, 35 acres; Overlook, 13 acres; Falulah, 6 acres.
4. 2,500 acres.
5. Hilly, wood and farming land.
6. Scott, 1,000,000 gallons; Falulah, 5,000,000 gallons.
7. Scott, 500 gallons; Falulah, 1,000 gallons.
8. No.
9. No.
10. Some large ponds, — one in Westminster, one in Ashburnham from 4 to 6 miles to main pipes.
11. None.
12. No.
13. Yes; black bass and land-locked salmon.
14. $500,000, total cost.
15. $35,000, damages.
16. No.

19. 1,000,000 gallons.
20. Thirty-five per cent.
21. 150 gallons.
22. Ten per cent.
23. One faucet, $6; each additional, $2; bath-tub or water-closet, $5; each additional, $3; hopper-closet, $8. Boarding-houses, one faucet, $10; each additional $2.50. Stores, offices, etc., $6 and upward. Stables, one horse, $5; each additional, $2. Hose for windows, gardens, sidewalks, etc., $5; nozzle to be not over one-fourth inch diameter, and time limited to one-half hour morning and evening. Cask of lime, 6 cents. Measured water, 10 to 35 cents per 1,000 gallons.
24. Gravity.
25. Water debt, $450,000; sinking fund, $123,522.90.
26. Sewers.
27. Nashua River.
28. None.

Gardner.

1. Gardner Water Company.
2. Crystal Lake in Gardner.
3. 156 acres.
4. One square mile.
5. Hard pan and gravel; hills with slight coating of loam.
6. No data.
8. No.
9. No.
10. None.
11. Cemetery.
12. State Board of Health, 1881; no figures given.
13. Yes.
14. $125,000 cost.
15. Yes, at slight cost.
16. None.
17. None.
18. None.
19. 141,000 gallons.
22. None.
24. Pumping into reservoir.
25. $60,000 six per cent. bonds, sixteen years to run.
27. Miller's River.
28. Stop use of cemetery.
29. No estimate.

Leominster.

1. Leominster Water Board.
2. Morse Brook with its tributaries, Haynes Brook, Quarter-of-a-mile Brook, Stalk Brook and Hale Brook.
3. Haynes reservoir, 70 acres; Morse reservoir, 11 acres; distributing reservoir, 5 acres; total, 86 acres.
4. 1,215 acres.

5. Hard, rocky, clay and gravelly land, without much swamps, except at Haynes reservoir; surface of ground uneven. High, steep hills, some of solid rock, making a quick watershed.
6. 1,800,000 gallons; might easily be made 2,000,000 gallons, facilities for additional storage being ample.
7. 500,000 gallons.
8. No.
9. No.
10. One other source, where 178 acres of watershed can be connected by a conduit 80 rods long.
11. None.
12. J. R. Nichols. Residue — 1.51, fixed; .87, volatile; 2.58, total.
13. No.
14. $179,524.62, cost; water rights, $20,001.39.
15. Can be doubled at a cost of $50,000; damage not over $10,000.
16. No.
17. No.
18. No.
19. Estimated at 800,000 gallons.
20. Fifty per cent.
21. 50 gallons estimated.
22. Five per cent.
23. One faucet, $6; each additional, $2; bath-tub or water-closet, $5; each additional, $2. Stores, offices, etc., $6 and upwards. Stables, one horse, $4; each additional, $2. Cask of lime, 6 cents. Measured water, per 1,000 gallons, 25 cents.
24. Gravity.
25. $100,000, debt.
26. By surface drainage, and partly by sewers.
27. Nashua River.
28. None.

Milford.

1. Milford Water Company.
2. Charles River.
3. 90 acres.
4. Four square miles.
5. Very steep.
6. 500,000 gallons.
7. No data.
8. No.
9. No.
10. No.
11. None.
12. (*See page 281.*) From supply well.
13. No.
14. $199,613, total cost; no water damages.
15. $10,000.
16. No.
17. No.

18. No.
19. 300,000 gallons.
20. Sixty per cent.
21. 400 gallons.
22. 100,000 gallons per day.
23. Water rates, first fixture, $6; second faucet, $2; each additional faucet, $1; water-closet, $3; bath-tub, $3. Private stable, first horse, $5. Meter rates, less than 1,000 gallons per day, 30 cents per 1,000; between 1,000 and 2,000 gallons per day, 27½ cents; between 2,000 and 3,000 gallons per day, 25 cents; between 3,000 and 4,000 gallons per day, 20 cents; between 4,000 and 5,000 gallons per day, 17½ cents; over 5,000 gallons per day, 15 cents; provided that no private house shall pay over $20, exclusive of lawn hose. For hotels, factories and large consumers, special rates will be made.
24. Direct pumping.
25. $16,000, debt; $4,000, sinking fund.
28. None.

Northborough.

1. Northborough Water Works.
2. Reservoir in Shrewsbury. Storage reservoir contains 30,000,000 to 35,000,000 gallons.
3. 9 acres.
4. 1,400 acres.
5. Rocky and hilly.
9. No.
10. Two or three small sources of not much value.
11. Small saw and grist mill.
12. Yes; no figures given.
13. No.
14. Cost $66,991.84.
15. Present dam made sufficiently high to add 15,000,000 gallons more water at a cost of $2,000.
16. No.
19. 40,000 gallons.
20. Large per cent.
22. Ten per cent.
24. Gravity.
25. $61,500 water debt.
26. Surface drainage.
27. Assabet River.
28. None.

Southbridge.

1. Southbridge Water Supply Company.
2. Harding Brook.
3. Approximately, 3 acres.
4. 180 acres.
5. Highlands, abrupt in fall, mowing, pasture and woodlands.
6. No estimate.

7. No estimate.
8. None.
9. No.
10. Yes; Hatchet Brook can be turned into the valley of our supply by use of pipes of a mile to a mile and a quarter.
11. None.
12. No analysis has ever been made.
13. No.
14. $21,472.90.
15. Yes; cannot estimate cost.
16. No.
17. None.
18. None.
19. No data.
22. Five per cent.
23. One faucet, $6; each additional, $1; bath-tub, $3; each additional, $2; water-closet, $4; each additional, $2; hopper-closet, $6. Boarding-houses, one faucet, $8; each additional, $2. Stables, one horse, $4.
24. Gravity.
25. No debt.
26. Cesspools and surface drainage.
27. Quinebaug River.
28. None.

Spencer.

1. Spencer Water Works.
2. Shaw Pond in Leicester.
3. $67\frac{8}{10}$ acres.
4. 155 acres,
5. Hills of gravel, partially wooded.
8. No.
9. No.
10. None.
11. Decay of vegetable matter.
12. Yes; no figures given.
13. Black bass.
14. $241,079.09, cost to date.
15. Yes; approximate cost, $2,000.
16. No.

Uxbridge.

1. Uxbridge Water Company.
2. Source in Uxbridge.
3. Supply is from underground springs; conveyed to reservoir by deep, underground trench.
6. 28,800 gallons.
7. Have one main trench and others leading to it.
8. No.
9. None.
10. None.

11. None.
12. No.
13. No.
14. $25,000.
15. Can be increased without damage to other parties for a small expense, approximately $500.
16. No.
17. No.
18. No.
19. 6,000 gallons, approximately.
20. 100 gallons per day.
22. Small.
23. $6 for single faucet.
24. Gravity.
25. Mortgage and corporation note.
26. Cesspools, etc.
28. None.

Webster.

1. Webster Water Company.
2. Lake Chaubunagungamaug, in Webster.
3. 1,280 acres.
4. Eight to nine square miles, including lake.
5. A semi-circular range of hills, wooded, north and east of lake, from 200 to 300 feet high, which supply three brooks, about equal in size. These brooks are nearly dry in summer.
6. The brooks and springs furnish about 12 feet of water in depth annually.
8. No.
9. This is used by the proprietor only as a mill power. The lake varies from 8 to 40 feet in depth; is drawn down about 4 feet late in the fall.
10. None.
11. None.
12. None.
13. Black bass, carp and lake trout.
14. $25,000.
15. No increase possible.
16. No.
17. No.
18. No.
19. 25,000 to 30,000 gallons.
20, Seventy-five to eighty per cent.
21. 180 gallons.
22. Ten per cent.
23. First faucet, $5.
24. By reservoir 40 to 100 feet above consumer, 70 feet on an average.
25. None.

26. French River.
27. To Norwich, Conn.
28. None.
29. None.

Westborough.

1. Westborough Water Works.
2. Surface Pond, formerly Mill Pond.
3. 56 acres.
4. 675 acres,
5. Gravelly.
6. No data.
7. No data.
8. No.
9. No.
10. Jack Straw Brook, 450 acres.
11. None.
12. Not recently.
13. Yes.
14. $30,000.
15. Yes; $10,000.
16. No.
17. 4,880.
23. Dwelling-houses, for first faucet, $5; each additional faucet, $1; bath-tub, $3; water-closet, $8 to $4. Boarding-houses, first faucet, $8; each additional faucet, $1. Stores, etc., $5. Stables, first horse, $3; each additional horse, $2; first ox or cow, $2. Each cask of lime or cement used, 5 cents. Metered water, for all water more than 100,000 gallons, and less than 1,000,000 gallons, per 1,000 gallons, 15 cents.
24. Gravity.
25. Water debt, $79,000; sinking fund, $8,018.92.
26. Surface drainage.
27. Cedar Swamp Pond.

Worcester.

1. Worcester Water Works.
2. Lynde Brook, Leicester, Mass.; Tatnuck Brook, Holden, Mass.
3. Lynde Brook reservoir, 155 acres; Holden reservoir, 94.5 acres; Bell Pond, 11.13 acres.
4. Lynde Brook, 1,150 acres; Holden, 2,950 acres; Bell Pond, very small.
5. Very hilly; soil generally hard pan, with underlying bed of rock.
6. The city utilizes all of the water flowing in the stream at Holden and all at Lynde Brook. Estimated average capacity of the stream at Holden 5,000,000 gallons per day, and at Lynde Brook 2,225,000 gallons per day, through the year; capacity of Lynde Brook reservoir, 680,000,000 gallons; Holden reservoir, 364,500,000 gallons.
7. Holden, about 3,500,000 gallons per day; Lynde Brook, about 1,500,000 gallons per day.

8. We are at the head of the stream in each case, upon branches of the Blackstone River; there are no parties who use the stream above us.

10. Kettle Brook, Leicester; watershed about 1,680 acres, by channel 2,000 feet long; 6 miles from city.

11. Not any.

12. No.

13. Lynde Brook with black bass, Holden reservoir with salmon, two years ago; in both cases by the city.

14. $1,720,329.62; damages for Holden not yet settled; Lynde Brook, $38,482.23.

15. The storage capacity of each reservoir can be increased with the exception of Bell Pond.

16. No.

17. No.

18. No.

19. 3,450,000 gallons.

20. Sixty-six and two-thirds per cent.

21. 312⅜ gallons.

22. 100,000 or more.

23. 15, 20 and 25 cents per 1,000 gallons metered water.

24. Gravity.

25. No sinking fund.

26. Mill Brook sewer.

27. Blackstone River.

28. Not any.

RECAPITULATION.

[Such points only will be enumerated here as require further notice for the purposes of comparison.]

1. Since the date of the last report, water supplies have been introduced in eighteen additional municipalities in the State, the greater number of which were small towns of less than five thousand inhabitants. Six of these were public supplies owned by the towns, and the remaining twelve were owned by private corporations.

2. Sources of water supply: —

(a.) *Lakes, and large ponds or reservoirs, either natural or artificial.*

Report of 1883,	39
Present report,	7
Total,	46

(c.) *Brooks, springs on small streams not liable to pollution.*

Report of 1883,	20
Present report,	2
Total,	22

(d.) *Filtering-galleries, or wells.*

Report of 1883,	9
Present report,	11
Total,	20

Two of this number are also included in class (a); both methods of supply being employed in each case.

(e.) *Tubular wells.*

Report of 1883,	2
Present report,	1
Total,	3

But few of the points to which replies are given in the returns require further notice here.

11. Upon this important point, from the character of the replies, it would be inferred that the new water-supplies must be unusually free from danger of pollution. One company reports danger "from dwellings," another from "vegetable growths," the nature of which are not specified. The former sort of danger (from dwellings) is one that should receive the most careful attention. The recent experience of the town of Plymouth, Penn., proves that even a single dwelling, so situated that its sewage may drain into the public water-supply, may be the means, through its occupants, of producing a disastrous epidemic among the inhabitants using the water.

12. Analyses of such waters as have been reported are herewith presented. (See pp 280, 281.)

14, 19, and 25. The replies to these questions, relative to the finances of water companies, and also the consumption of water, are grouped together for the sake of convenient reference and comparison.

The returns from some of the smaller companies are incomplete in these particulars, and in the case of a few of the larger companies, the estimate of 1883 is given where no replies are returned.

From the figures presented, it appears that the total cost of works in operation, in Massachusetts up to the present year, so far as can be ascertained from the returns, is $49,640,179.26, — being an increase of 19 per cent. over the sum reported in 1883. Of this sum, $1,038,410.51 is reported as paid for water-rights and land damages.

The same companies also report the sum total of $32,569,966.50 as their debt, — an increase of 18 per cent. over the amount returned in 1883.

The increase in the amount of sinking fund is much larger than that of the debt; the sum of $6,866,252.37 having been reported as the amount of sinking funds, — an increase of 48 per cent. over the figures of 1883.

The population of cities and towns supplied with public water is reported as 1,370,627, — an increase of 23 per cent. over the number reported in 1883.

The daily consumption of water as reported by all the reporting works is 76,743,773, — an increase of 11 per cent. over the amount reported in 1883. (See p. 282.)

The actual population supplied must necessarily be considerably less than the number reported, which includes the entire population of reporting towns; a considerable number of whom, especially in the outskirts of cities and towns which have recently constructed water-works, are not actual consumers, a fact which accounts for the difference between the rate of increase of population and that of the daily average consumption, as well as the diminution in the consumption per capita, which, for the present report, amounts to 56 gallons, as against 62 gallons for 1883.

Water Analysis — in parts per 100,000.

LOCALITY.	DATE.	Unfiltered. Ammo.	Unfiltered. Alb. Ammo.	Chlorine.	Residue. Fixed.	Residue. Volatile.	Residue. Total.	Hardness.	Oxygen required — Kubel's method.	REMARKS.
North Attleborough,	Nov. 7, 1884,	.0010	.0148	.56	5.	2.7	7.7	1°	.	Slightly turbid; considerable brownish sediment; color, none; odor, none; slight blackening on ignition; nitrates absent; a good surface water. Prof. E. S. Wood.
New Bedford, —										
Little Quittacus,	Oct. 15, 1885,	.004	.019	.49	1.78	1 40	3.18	.	.435	
Storage reservoir,	" "	.006	.023	.52	3.68	2.08	5.76	.	.785	
" "	" "	.003	.033	.53	2.92	1.52	4.42	.	.927	
Receiving reservoir,	" "	.002	.039	.53	2.72	1.64	4.36	.	1.067	
Distributing reservoir,	" "	.011	.037	.57	2.52	1.90	4.42	.	1.048	
City Hall,	" "	.002	.031	.55	2.68	1.88	4.56	.	.928	
Lynn, —										
Breed's pond,	April, 1885,	.0052	.024	.	.	.	5.9	.	.	A pure and soft water for domestic use. C. Palmer.
Birch pond,	" "	.0140	.026	.	.	.	5.2			
Hawkes brook,	" "	.005	.020	.	.	.	5.00			
Lawrence, —										
Reservoir (below ice),	April, 1881,	.0048	.0180	.14	2.10	2.40	4.50	1½		
City Hall,	" "	.0048	.0182	.18	2.20	1.70	3.90	1½		
Filter gallery,	" "	.0099	.0074	.80	10.00	2.20	12.20	5		
Dalton, —	March, 1884,	.0072	.0072	.05	1.5	2.4	3.9	0.5	.	E. S. Wood.

Winchester, — Highland reservoir, . . .	Dec.,	1885,	.0122	.0256	.75	3.7	2.8	6.5	1	.	Considerable blackening on ignition of residue. E. S. Wood.
Amherst, — Water Company, . . .	June,	1885,	.0036	.0140	0.3	2.5	1.6	4.1	1		
Spring Water Company, . .	"	"	.0024	.0028	0.3	2.8	0.7	3.5	1		
Wakefield, — Wakefield Water Company, .	. . .	.	.0020	.0060	.	2.5	2 5	5.00	.	.	S. P. Sharples.
Newton, — Filtering gallery, . . .	Aug.,	1885,	.0002	.0006	.40	2.30	1.70	4.00	1	.	E. S. Wood.
Wellesley, ...	Dec.,	1884,	.012	.009	.	6.00	1.25	7.25	.	.	S. P. Sharples.
Middleborough, . . .	April,	1886,	.0004	.0010	1.20	4.00	3.90	7.90	4	.	Clear; odor, none; color, none; no blackening on ignition; nitrates absent; an excellent water. E. S. Wood.
Athol, — Reservoir, ...	June,	1881,	.0206	.0494	.20	1.70	3.60	5.30	½		
Nantucket, — Wannacomet water, . .	Oct.,	1883,	.0102	.0210	2.90	4.50	2.50	7.00	1	.	E. S. Wood.
Milford, — Supply well, ...	Dec.,	1883,	.0138	.0054	.40	.50	1.50	2.00	¾	.	No color; no turbidity; no odor; very clear. E. S. Wood.

Summary by Counties.

COUNTIES.	Population of Cities and Towns supplied.	Daily Consumption in Gallons.	Cost of Works.	Water Rights.	Amount of Water Debt.	Sinking Fund.
Barnstable,*	-	-	-	-	-	-
Berkshire,	56,522	4,670,000	$809,859 91	$7,814 45	$432,904 04	None.
Bristol,	127,105	5,382,923	3,403,108 96	33,739 56	2,949,823 48	$140,654 00
Dukes,*	-	-	-	-	-	-
Essex,	181,640	9,950,715	5,584,059 07	25,828 05	3,785,965 05	689,683 24
Franklin,	5,569	400,000	142,000 00	-	95,000 00	None.
Hampden,	90,665	4,075,000	2,160,702 81	26,494 03	1,715,000 00	75,890 93
Hampshire,	21,054	694,200	385,513 50	28,406 17	235,000 00	19,329 95
Middlesex,	235,821	9,524,502	10,456,287 01	216,428 36	6,179,300 00	1,908,198 21
Nantucket,	3,143	58,000	-	-	27,000 00	1,000 00
Norfolk,	39,225	1,310,292	1,485,179 67	28,626 06	1,061,000 00	3,000 00
Plymouth,	42,735	542,191	949,676 08	53,058 08	640,000 00	37,101 74
Suffolk,	416,115	33,844,550	20,694,781 18	543,190 64	14,364,473 93	3,850,852 48
Worcester,	150,033	6,291,400	3,569,011 07	74,825 11	1,084,500 00	140,541 82
Totals,	1,370,627	76,393,773	$49,640,179 26	$1,038,410 51	$32,569,966 50	$6,866,252 37

* No water supplies for public, domestic and general use.

GENERAL INDEX OF THE HEALTH SUPPLEMENTS

(I., II., * IV., V., VI., VII.)

TO THE

ANNUAL REPORTS

OF THE

STATE BOARD OF HEALTH, LUNACY, AND CHARITY:

TO WHICH IS ALSO APPENDED

AN INDEX OF THE CHAPTERS AND OTHER MATERIAL RELATIVE TO PUBLIC HEALTH CONTAINED IN THE SEVEN ANNUAL REPORTS OF THE BOARD.

* No supplement to the Third Report was issued.

GENERAL INDEX.

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